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INTERNATIONAL TECHNOLOGY CORPORATION

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Final Report

~~Final~~ Feasibility Study Report Alsco-Anaconda NPL Site Gnadenhutten, Ohio

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1.0 INTRODUCTION

Atlantic Richfield Company (ARCO) has retained IT Corporation (IT) to conduct a Feasibility Study (FS) in accordance with the Administrative Order, by Consent, U.S. Environmental Protection Agency (U.S. EPA) Docket No. U-W-87-C-002.

In June of 1986, the U.S. EPA included the Alsco-Anaconda site on the National Priorities List (NPL) as an uncontrolled hazardous waste site under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 due to the actual or potential release of hazardous substances from this site. CERCLA, through Executive Order 12316, gives the U.S. EPA the authority to respond to actual or potential release of hazardous substances that pose a substantial threat to public health and welfare, and the environment. CERCLA was amended on October 17, 1986 to include the Superfund Amendments and Reauthorization Act of 1986 (SARA). This FS is based on the provisions of SARA and the interim final guidance document dated August 1988.

The purpose of this FS report is to present and discuss the process used to develop remedial action alternatives for the Alsco-Anaconda NPL site. The information and data used to develop the remedial action alternatives are presented in the Remedial Investigation (RI) report and the analytical data is summarized in Appendix C.

This document divides the procedures required for completion of the FS into the following broad categories:

- Development of Remedial Action Alternatives
- Screening of Remedial Action Alternatives
- Detailed Analysis of Remedial Action Alternatives

In the first category, "Development of Remedial Action Alternatives," general qualitative information is used to develop the range of technologies to be assembled into remedial action alternatives. Effectiveness, implementability, and relative costs were the criteria used for broad screening during the development of these alternatives.

In the second category, "Screening of Remedial Action Alternatives," the alternatives are further screened to reduce the number of alternatives subject to detailed analysis. The same criteria of effectiveness, implementability, and cost were used.

In the third category, "Detailed Analysis of Remedial Action Alternatives," a detailed evaluation of each remaining alternative is conducted to provide the required information to recommend a site remedy in accordance with the guidelines in Section 121 of SARA and the National Contingency Plan (NCP) which defines the appropriate extent of remedy as a "cost-effective" remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment.

1.1 SITE BACKGROUND INFORMATION

Gnadenhutten, a community of about 1,320 residents, is located in Tuscarawas County, about 49 miles south of Akron, Ohio. The former ARCO Alsco plant, a fully integrated mill product and extrusion facility that produces painted and unpainted architectural aluminum building products, is located within the Gnadenhutten village limits on 23.6 acres along the flood plain of the Tuscarawas River (Figure 1-1). The present Alsco plant occupies 18.9 acres of the original 23.6 acres, excluding approximately 4.8 acres retained by ARCO (Figure 1-2). Structures at the former ARCO facility include an aluminum processing plant, an office building, a security and scale house, a wastewater treatment plant, a sludge settling basin, and a sludge disposal pit (Figure 1-2). Water resources upgradient and within one mile of the site include the Tuscarawas River and the Gnadenhutten municipal well field. Several private water wells are located approximately three quarters of a mile downgradient of the site (Figure 1-1).

1.1.1 Site History

During the period from 1965 to 1978, the settling basin and sludge pit were used for the disposal of chromium- and cyanide-containing sludge, which consists mostly of aluminum oxyhydroxides, calcium carbonate, calcium sulfate, and water. As a result of effluent overflow from the basin of plant wastewater, sludge is now located in a wooded marsh (swamp) area adjacent to the settlement basin. Because of a concern for the potential contamination of water resources from the sludge leachate, the site was proposed for inclusion on the NPL of sites eligible for cleanup under the CERCLA of 1980 in October 1984. The site was formally placed on the NPL in June 1986.

In December 1986, ARCO sold the Alsco plant to Pony Industries, Inc., a subsidiary of Horsehead Industries, Inc. However, ARCO retained ownership of the portions of the plant site which were used for sludge disposal and is included on the NPL. This approximately 4.8-acre area, including the settlement basin (impoundment), sludge pit, swamp, and adjacent property to the Tuscarawas River constitutes the Alsco-Anaconda NPL site as referred to in this report (Figure 1-2). The Alsco-Anaconda NPL site is bounded by the Tuscarawas River, the Penn-Central Railroad right-of-way, the Alsco manufacturing building and parking lot, and Anaconda Drive (County Road 39) on the southwest, northwest, northeast, and southeast, respectively.

1.1.2 Regional Physiography, Geology, and Hydrogeology

Gnadenhutten is located in east-central Ohio within the unglaciated Kanawha section of the Appalachian Plateau's physiographic province (Fenneman, 1946; Goldthwait and others, 1967). The plant site occupies a portion of the Tuscarawas River valley flood plain, which is about 1.5 miles wide and which is relatively flat, with valley floor elevations from 820 to 850 feet above mean sea level (MSL) in the vicinity of Gnadenhutten (Figure 1-1). Within a two-mile radius of the site, peak elevations approach 1,250 feet above MSL.

Subsurface materials in the Tuscarawas River valley consist of unconsolidated fluvial silt and sand deposits, along with glacial outwash sands, silts, and gravels. This valley fill overlies relatively flat-lying sedimentary bedrock, mostly shale and sandstone with minor beds of limestone and coal (Brownocker, 1947; Lamborn, 1956), generally occurring greater than 160 feet below the site surface. The surficial deposits of sand and gravel and bedrock formations of shale, limestone, and coal are mined locally. Within a two-mile radius of the site, there are several sand and gravel pits in the valley bottom and coal strip mines on the valley sides.

The unconsolidated alluvial valley deposits form extensive aquifers (Cummins, 1959) which are the principal water supplies for municipalities in the valley. A regional water table map (Figure 1-3) based on available data from the Ohio Department of Natural Resources (ODNR) shows that the water table configuration is a subdued expression of the topography, generally with a flat surface interrupted by cones of depression in the valley and an irregular, steep gradient leading to ground water divides through the uplands. Ground water flow from the uplands is toward the Tuscarawas River Valley. Ground water flow in the valley is generally southwestward (down river) except in the general vicinities of municipalities such as Tuscarawas, Warwick, Gnadenhutten, and Seventeen.

Nine 50-foot-deep ground water monitoring wells were installed at the Alsco-Anaconda NPL site to characterize the local ground water quality and flow direction. The nine monitoring well borings each encountered the coarse alluvial valley deposits (mainly medium dense sands and fine gravels with some lenses of sand and silt). One site production well (PW-5) boring encountered similar materials to a depth of 159 feet (Ohio Drilling Company, 1980). None of the site wells encountered bedrock. Water table measurements from these on-site wells indicate the local flow is generally to the southwest toward the Tuscarawas River, with the exception of inward-radial flow proximal to Pumping Well PW-5.

1.2 NATURE AND EXTENT OF THE PROBLEM

Waste streams associated with the aluminum siding manufacturing process at the ARCO facility included wastewater and a wastewater treatment sludge from the conversion coating of aluminum forms as pretreatment for painting. This sludge is a process waste which is included in the Resource Conservation and Recovery Act (RCRA) list of hazardous wastes (F019), because the sludge contains chromium and cyanide.

The F019 sludge has been listed on the Land Disposal Restrictions (LDR) for the Second Third Scheduled Wastes (Proposed Rule; 40CFR148, 268, and 271). The U.S. EPA is proposing to prohibit the land disposal of certain untreated hazardous wastes listed in 40CFR268.11. Therefore, the F019 waste sludge must be treated prior to any on- or off-site disposal of the sludge. This LDR regulation will be a mechanism which needs to be dealt with in the developing of remedial action alternatives in determining a remedy for the Alsco-Anaconda NPL site.

1.2.1 Current and Potential Situation

During the period from 1965 to 1978, the sludge was deposited on site mainly in the settlement basin (impoundment) and sludge pit, where it accumulated to present quantities. The impoundment and sludge pit combined occupy approximately four-tenths of an acre. The depth of the sludge in these unlined excavations is approximately eight feet in the impoundment and seven feet in the sludge pit. The estimated total volume of sludge in both excavations is 5,570 cubic yards. In addition, nearly 1.2 acres of the swamp area adjacent to the impoundment are covered by sludge, with an average thickness of about 1.7 feet. The estimated volume of sludge in the swamp is 3,280 cubic yards. Assuming an average density of 3,000 pounds per cubic yard, the total sludge volume of 8,850 cubic yards at the Alsco-Anaconda NPL site would weigh approximately 13,275 tons.

The sludge consists mostly of aluminum oxyhydroxides, calcium carbonate, calcium sulfate, and water with lesser amounts of various other inorganic and organic constituents. Trace component concentrations vary depending on activities, processes, or sources that differed over time. In addition to cyanide and chromium, the sludge was found to contain several other potentially hazardous or toxic substances, including fluoride, nitrate, volatile organic compounds, and polychlorinated biphenyls (PCBs).

The nature of the problems associated with these constituents depends on the environmental distribution of hazardous chemicals and on the potential for the migration of contaminants to potential receptors. Because some of the sludge is present in areas subject to flooding, the potential for mass movement exists. The Gnadenhutten municipal water supply is derived from wells upgradient from the site and not the Tuscarawas River. Therefore, potential impacts from the unmitigated site are greatest for the Tuscarawas River biota, fishermen, trappers, and others that may contact the contaminated waste.

1.2.2 Historical Waste Management Practices

Prior to 1965, neutralized process wastewater was discharged directly to the Tuscarawas River. Historical information indicates that wastewater discharge from the aluminum conversion coating process was approximately 400 gallon per minute (gpm) and had suspended solids concentration of about 125 parts per million (ppm). The suspended solids primarily consisted of sodium aluminate and aluminum hydroxide, which were precipitated from the etching process wastewater. The sodium aluminate was derived from the reaction of sodium hydroxide with the dissolved aluminum. Hexavalent chromium was also present as neutral sodium chromate. Sodium chromate was formed by neutralization of chromic acid residues present in the wastewater from the chromic acid treatment of aluminum.

The settlement basin was completed in 1965 at the request of the State of Ohio Department of Health and, during the period from 1965 to late 1972, was used to remove the settleable solids from the coating process wastewater. Prior to 1972, the aluminum pretreatment wastewater was discharged directly to the Tuscarawas River under Industrial Waste Permit No. 1495.2 issued by the State of Ohio Water Pollution Control Board.

Beginning in late 1972 or early 1973, Alsco began operating a chromium reduction wastewater treatment process that generated a metallic hydroxide sludge, which primarily consisted of aluminum hydroxide and trivalent chromium hydroxide, plus calcium carbonate, and calcium sulfate.

The precipitation of the metal hydroxide sludge took place in the settlement basin and the clear overflow was discharged to the adjacent Tuscarawas River under a National Pollutant Discharge Elimination System (NPDES) permit issued in 1972. The wastewater entered the impoundment on the south side where the larger and heavier particles were expected to settle. The clear overflow discharged from the north side of the impoundment where the finer precipitates were expected to settle. Periodically, as the settlement basin filled with wastewater treatment sludge, a dragline was used to remove the sludge for disposal into an adjacent sludge pit. The aluminum pretreatment wastewater was treated in this manner until 1978, when a plate and frame filter press was installed in the wastewater treatment building for the removal and dewatering of the sludge.

Since 1978, no solid waste has been placed into the impoundment or sludge pit; wastewater treatment sludges have been mechanically dewatered on site and transported to an off-site facility for disposal. However, the treated wastewater discharge route included the impoundment until October 1980, when the effluent discharge was rerouted around the impoundment to the swamp, which drained to the river. The treated process wastewater has been discharged to the Tuscarawas River through an NPDES permitted outfall since 1972.

Prior to 1978, when the settlement basin and sludge pit were an active part of the wastewater treatment process, three chemical pretreatment lines contributed to the system. Two of these lines were used to process aluminum coil while the third line treated aluminum extrusions. The purpose of each pretreatment line was to prepare the aluminum for subsequent painting operations by cleaning (etching) the metal and applying an amorphous chromate coating to enhance corrosion resistance and to provide a basis for paint adhesion. Following the pretreatment processes, the aluminum coils or extrusions were transferred by lift truck to the painting operations located elsewhere in the plant.

The etchants consisted primarily of sodium hydroxide and detergents. The chromate coating solutions consisted of mixtures of hexavalent chromium as chromic acid, hydrofluoric and nitric acids, and ferro-ferri cyanide which was used as a catalyst (accelerator). The drag from the three pretreatment lines contained small amounts of chromic, hydrofluoric, and nitric acids plus cyanide as well as the reaction products from the conversion coating process. The continuous overflows and periodic bath discharges from the pretreatment lines were routed into a drain system, which was isolated from the general plant sewer system, and which carried the waste effluent directly to the wastewater treatment building.

In October 1986, the outflow from the wastewater treatment plant was rerouted away from the swamp directly to a NPDES permitted outfall at the Tuscarawas River to dry the swamp area. No standing water was present in the former marsh area within one month following the diversion of the outfall. Similarly, after the effluent was diverted to bypass the settlement lagoon in 1980, standing water was eliminated in the settlement lagoon and sludge pit.

1.3 REMEDIAL INVESTIGATION SUMMARY

The purpose of the RI was to determine the nature and extent of contamination at the Alsco-Anaconda NPL site and the potential environmental impact of site conditions and contaminant migration.

RI activities for the Alsco-Anaconda NPL site have been conducted in accordance with CERCLA and National Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] 300) guidelines and applicable U.S. EPA and Ohio Environmental Protection Agency (OEPA) requirements. Several phases of field activities, sample collection, and chemical constituent analyses were planned and conducted during the period from March 1985 through January 1987. The project tasks were performed in accordance with Revision I and Addenda I and II of the RI Work Plan and Revisions I, II, or III of the Quality Assurance Project Plan (QAPP), documents which were prepared by IT for ARCO and which were reviewed and approved by representatives of the U.S. EPA Region V and the OEPA.

The scope of the RI for the Alsco-Anaconda NPL site consisted of the following:

- Determine if ground water or surface water contamination has occurred on site and/or off site as the result of contaminant migration from the site and determine the quality, concentration, and direction of contaminant flow

- Identify any contaminated soil and/or sediment that may be present on or adjacent to the site as the result of migration from the site

- Identify specific contaminants posing acute or chronic hazards to the public health, welfare, or the environment

- Identify existing or potential pathways and receptors of contaminant migration from the site which affect or may pose a threat to the public health, welfare, or the environment (Endangerment Assessment)

The data-gathering activities necessary to meet the RI Work Plan objectives emphasized sampling of the following on-site and off-site matrices:

- Sludge pit and settlement lagoon wastes and underlying soils
- Ground water
- Swamp area sludge and underlying soil
- Tuscarawas River sediments

Each medium was sampled from multiple source locations in accordance with the Work Plan. Sample chain-of-custody procedures were followed from the time of sample collection through analysis and archiving. Initial field investigations and laboratory studies were performed in accordance with the OEPA approved March 1985, Revision I, Quality Assurance/Quality Control (QA/QC) Plan. U.S. EPA Region V assumed primacy for regulatory review of the RI/FS in February 1986 following the addition of the site to the NPL. The U.S. EPA conducted an audit of RI laboratory data in April 1986 and ruled that the existing OEPA-approved QA/QC Plan did not meet U.S. EPA requirements and future analyses had to be performed in accordance with U.S. EPA Contract Laboratory Program (CLP) analytical procedures. The original March 1985 QA/QC Plan had specified U.S. EPA approved Safe Drinking Water Act and SW-846 laboratory procedures. As a result of the U.S. EPA audit the July 1986 Revision II Quality Assurance Project Plan (QAPP) was generated and final U.S. EPA approval of the QAPP was received November 7, 1986 (October 1986, Revision III, QAPP). All subsequent analyses were performed in accordance with CLP laboratory procedures.

The Alsco-Anaconda NPL site RI began with an initial site screening program from March through May 1985 that involved the installation of nine monitoring wells and the collection of borehole soil samples, ground water samples, and sludge and underlying soil samples from the sludge settlement, basin, the sludge disposal pit, and the swamp area along the riverbank that received outflow from the settlement lagoon and other plant discharges. Representative composite sludge and soil samples were analyzed for Hazardous Substance List (HSL) organic compounds, cyanide, fluoride, nitrate, hexavalent chromium, total chromium, and other total metals as well as leachable metals by the Extraction Procedure (EP) toxicity test method. Ground waters was monitored quarterly through January 1986 and again in November 1986 for HSL organic compounds, cyanide, fluoride, nitrate, chromium, and selenium, including water levels, pH, temperature, and specific conductance.

Because PCBs were found in swamp sludge and soil samples and considering other results from the first phase RI field and analytical tasks, the second phase of sampling and analysis was planned. The second phase was conducted during the period from November 1986 through January 1987 in order to repeat sampling of the monitor wells, settlement lagoon, and sludge pit, to provide more extensive coverage in the swamp area, and to include sediment sampling from the Tuscarawas River. The ground water, sludge, and soil samples were analyzed for identical parameters tested in the first phase, except the swamp samples and the river sediments were analyzed only for PCBs, total chromium, and hexavalent chromium.

1.4 BASELINE RISK ASSESSMENT

The principal environmental migration pathway for contaminant transport from the Alsco-Anaconda NPL site is water transport. The air pathway is not considered significant due to the high water content of the waste sludge on site and vegetation covering the waste disposal areas.

Dilution calculations have shown that, even under low flow conditions in the Tuscarawas River, the contribution of contaminants from the ground water will not have a significant impact on the public health or the environment.

A potential direct contact exposure scenario for two subpopulations was employed to assess the possible human health risks posed by contamination of the Alsco-Anaconda NPL site in Gnadenhutten, Ohio. These target subpopulations were defined to be children, ages 5 to 12 (average weight 25 kilograms) and adult workers with an average weight of 70 kilograms.

Of the potential contaminants found on the Alsco-Anaconda NPL site, only arsenic, cadmium, chromium, cyanide, and PCBs were found at levels thought to pose a potential hazard to human health. By comparing cadmium, chromium, and cyanide to established U.S. EPA standards for acceptable daily intake, the hazards posed by these compounds were shown to be, both individually and in a multiple exposure scenario, well below the U.S. EPA guidelines for a potential risk to human health.

Arsenic was evaluated with respect to carcinogenic effects on human health. The possible risk to human health posed by the presence of arsenic was estimated using a carcinogenic potency factor derived by the U.S. EPA. Excess cancer risk for arsenic at the Alsco-Anaconda NPL site was found to be 5.68×10^{-7} and 1.16×10^{-6} for a child and adult, respectively, based on the scenarios postulated. The affected population would be those exposed through direct contact with the soils only.

For PCBs, excess cancer risk was calculated using the U.S. EPA carcinogenic potency factor, which are data developed for carcinogens and potential carcinogens. Based on this health-protective scenario, excess cancer risk exists for those subpopulations who come in direct contact with the Area 4 sludges and Area 1, 2, 3, and 5 sludges at the site.[1] Direct contact with the remaining sludges and soils does not pose an unacceptable level of risk based on a total hazard index and risk characterization for both children and adults.

Organic constituents were evaluated with respect to both subpopulations. The hazard indices for a child and an adult worker are 0.01 and 0.005, respectively. Excess cancer risks due to organic carcinogens for a child and an adult are 1.38×10^{-8} and 2.81×10^{-8}, respectively. The organic constituents do not pose an undue risk at the site. Available data on the impact of these compounds on aquatic and wildlife suggest low potential for causing a toxic effect.

1.5 OVERVIEW OF METHODOLOGY

The FS is in the process by which measures for mitigating site-related contamination are evaluated. The general components of an FS are outlined in the NCP, 40CFR300.678, and are further explained in the August 1988, U.S. EPA documents "Guidance for Conducting Remedial Investigations, and Feasibility Studies Under CERCLA." With guidance from these documents, the FS for the Alsco-Anaconda NPL site was conducted using a multilevel screening and evaluation process. Technologies were identified and screened prior to the development of the remedial action alternatives. Subsequently, the initially assembled alternatives were screened to select the most feasible and effective alternatives for consideration in detailed cost-effectiveness evaluations.

[1]The swamp has been divided into Areas 1, 2, 3, 4, and 5 to better define the extent of contamination within the operable unit.

The objective of the screening of technologies was the elimination of all technologies that are either infeasible or inappropriate to the problem under study. Screening criteria were derived from two general categories in accordance with the guidance documents:

- Site conditions/characteristics
- Waste/contaminant characteristics

The technologies remaining after this screening were grouped in various combinations to form potential remedial action alternatives. In order to provide only a limited number of alternatives for consideration during detailed evaluations, this initial group of remedial action alternatives were screened with respect to effectiveness, implementability, and cost criteria.

The selected alternatives then underwent a detailed analysis. During the detailed analysis, each alternative was assessed against criteria relating to effectiveness, implementability, cost, compliance with ARARs, and overall protection of human health and the environment. Using the results of these assessments, the strengths and weaknesses of each alternative were identified and comparisons among the alternatives were made so that the most cost-effective and environmentally acceptable alternative can be selected for implementation.

1.6 OBJECTIVES OF REMEDIAL ACTION

To aid in achieving the general goal of Superfund site remediations, i.e., to protect the public health, welfare, and environment from adverse site-related impacts, the following remedial action objectives have been developed for the Alsco-Anaconda site:

The NCP states the general goals of remedial actions in 40CFR300.68(i):

> "The appropriate extent of remedy shall be determined by the lead agency's selection of a cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment."

SARA has expanded the scope of the NCP to include the following:

- SARA establishes that preference must be given to remedial actions "in which treatment which permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants is a principal element" (Section 121[b]). Further, SARA requires an explanation must be published if a permanent solution using treatment or recovery technologies is not selected.

- SARA also establishes general objectives for the degree of remedial action cleanup. Remedial action "shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further releases at a minimum which assures protection of human health and the environment" (Section 121[d]).

- SARA enacts the requirement that the selected remedy comply with or attain the level of the "legally applicable or relevant and appropriate standard, requirement, criteria, or limitation of any Federal or State environmental law" (Section 121[d]).

Medium-specific objectives for the Alsco-Anaconda NPL site are described below.

Solid Wastes, Liquid Wastes, Sludges, and Soils

- Prevent the ingestion or direct contact with solid wastes, liquid wastes, sludges, and soils having noncarcinogens in excess of reference doses or having 10^{-4} to 10^{-7} cumulative excess cancer risk from carcinogens. (Public Health Protection)

- Prevent the release of airborne contaminants from solid wastes, liquid wastes, sludges, and soils that would pose an unacceptable risk or cause inhalation of carcinogens resulting in cumulative excess cancer risk levels of 10^{-4} to 10^{-7} at receptor locations. (Public Health Protection)

- Prevent the migration or leaching of chemical substances to ground water, surface water, or other environmental media that would result in the exceedance of acceptable risk levels through exposure modes involving those media (e.g., ingestion of contaminated ground water). (Public Health Protection)

Ground Water

- Prevent the release of constituents that would result in current or future ingestion of ground water having carcinogens at concentrations that exceed established standards (e.g., maximum contaminant levels [MCLs]) or represent a cumulative cancer risk of greater than 10^{-4} to 10^{-7}, whichever is more stringent. (Public Health Protection)

- Prevent the release of constituents that would result in the actual ingestion of ground water having noncarcinogens at concentrations that exceed established standards or represent a cumulative cancer risk of greater than 10^{-4} to 10^{-7}, whichever is more stringent (e.g., acceptable daily intakes [ADIs]). (Public Health Protection)

Surface Water

- Prevent the release of surface water with contaminant concentrations greater than ambient water quality criteria (AWQC) or Ohio Water Quality Standards (OWQS). (Public Health Protection)

Sediment

- Prevent the direct ingestion of or contact with sediment having carcinogens in excess of 10^{-4} to 10^{-7} excess cancer risk or noncarcinogens in excess of reference doses. (Public Health Protection)

- Prevent the release of contaminants from sediments that would result in water column concentrations in excess of AWQC. (Environmental Protection)

Air

- Prevent inhalation of carcinogens in excess of 10^{-4} to 10^{-7} excess cancer risk and noncarcinogens in excess of reference doses. (Public Health Protection)

2.0 DEVELOPMENT AND SCREENING OF REMEDIAL ACTION TECHNOLOGIES

The initial work effort under the Remedial Action Technologies Development and Screening Task (Task 6 of the Alsco-Anaconda NPL site FS Work Plan) involved the following:

- Identifying the general remedial response actions which might be appropriate for addressing the environmental conditions associated with the Alsco-Anaconda NPL site
- Compiling potentially feasible technologies for each of the identified response actions
- Development criteria by which the compiled technologies can be initially screened prior to assembling the remedial action alternatives

This chapter summarizes and presents the results of the above-described requirements.

2.1 GENERAL REMEDIAL RESPONSE ACTIVITIES

The environmental conditions currently associated with the Alsco-Anaconda NPL site can be subdivided into two operable units based on the results from the RI:

- Impoundment area (includes the southern and northern impoundments and the sludge pit)
- Swamp area

The "swamp" is designated as the area located between the impoundments (which includes the sludge pit) and the Tuscarawas River. This area is located within a 100-year floodplain. Therefore, the swamp at different times during the year can be flooded out by an elevation change in the Tuscarawas River. The F019 sludge which has contaminated this area was caused by the overflowing of the impoundments. In addition, PCB contamination was discovered during the initial sampling during the Remedial Investigation.

The estimated volume of the F019 sludge in this swamp area is approximately 3,300 cubic yards, with an average thickness of 1.7 feet. Standing water is normally found in the swamp area after a rainfall or a flooding incident; otherwise, there is usually no standing water.

These two operable units were selected because the waste characteristics are distinctly different in the impoundment and swamp areas. Soil is ~~the~~ medium which is required to be addressed.

The ground water will be addressed in a separate FS as a single operable unit since extensive data gaps have been identified.

The remedial action objectives address and focus FS on the two operable units. Approximate response actions will be identified for each of the individual components.

The general remedial response actions and associated remedial technologies potentially applicable to the site-specific conditions are identified for each operable unit. These general remedial response actions and technologies are presented in Table 2.1.

The development of the remedial response actions applicable to the site requires a screening of the various remedial technologies and process options which have been established for each operable unit. The purpose of the screening process is to eliminate technologies and process options based on their applicability to the site-specific conditions.

The identification of applicable remedial technologies and process options for the impoundment area, swamp area, and ground water operable units are shown in Figures 2-1 and 2-2, respectively. These figures show the process which eliminated the technologies and process options which are not applicable to the Alsco-Anaconda NPL site and identifies the applicable technologies and process options which will require further screening. This screening is described in Chapter 3.0.

2.2 COMPILATION OF REMEDIAL TECHNOLOGIES

Potentially feasible technologies have been identified for each of the relevant response actions. These technologies are shown in Figures 2-1 and 2-2, respectively, for each operable unit. These figures represent the entire set of technologies to be considered during this FS.

2.3 DEVELOPMENT OF REMEDIAL TECHNOLOGY SCREENING CRITERIA

This section summarizes the results of the screening process for selection of the most viable technologies for remediation of the ~~three~~ two operable units: (1) southern and northern impoundments and sludge pit, & (2) swamp area~~, and (3) ground water~~. The goal of this screening process is to reduce the original large number of possible technologies to a smaller and more workable number of individual technologies which are considered applicable or appropriate for each of the above operable units. Only the technologies which pass this screening process will be considered in assembling the remedial action alternative arrays described in Chapter 3.0.

2.3.1 Screening Criteria

The screening criteria used for initial screening, presented in Figures 2-1 through 2-2 for each operable unit, are based on the applicability of the technologies with respect to the site condition and waste characteristics. A second screening was performed on the initially screened technologies and presented in Figures 2-3 and 2-4 for each operable unit. The screening criteria for the second screening are primarily based on effectiveness, implementability, and with less emphasis on the relative operating and/or capital cost.

2.3.1.1 Effectiveness Evaluation

This criterion evaluates short- and long-term effectiveness of specific process options (techniques) in protection of human health and the environment during and after the construction and implementation period until the response objectives have been met. The primary consideration is to evaluate the effectiveness of the process option to handle the specific type of waste/contaminant; volume, quantity, or concentration of waste/constituent; physical/chemical properties; toxicity or degree of hazard; and site conditions and characteristics. Additionally, the primary focus of the long-term criterion is the extent, adequacy, and reliability of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

2.3.1.2 Implementability Evaluation

The implementability criterion addresses the technical and administrative feasibility of implementing a technique and the availability of various services and materials required during implementation. This criterion involves analysis of the following considerations:

- Technical difficulties and unknowns associated with a technology
- Reliability of a technology to meet specified process efficiencies or performance goals
- Availability of adequate off-site treatment, storage capacity, and disposal services
- Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources
- Timing of the availability of technologies under consideration

2.3.1.3 Cost Evaluation

Cost plays a limited role in the screening of techniques. Relative capital and operation costs are considered rather than detailed estimates. For this evaluation, the cost analysis is made on the basis of engineering judgment, and each technique is evaluated as whether costs are high, medium, or low relative to other techniques in the same technology type.

2.3.1.4 Screening Objective

The objective of this screening is to select the most viable technologies from the identified remedial technologies that can be effectively implemented for the known waste and site-specific characteristics.

2.4 TECHNOLOGY SCREENING BY GENERAL RESPONSE ACTIONS

In this section, techniques within each technology are compared and the preferred techniques are retained for further consideration and discussion. In the following section, a description of the applicable technologies and process options are provided for all of the operable units. The applicability of a technique to a specific operable unit is appropriately noted in the discussion. The remaining techniques which do not apply or meet the previously defined objectives for this site will be eliminated from further consideration.

2.4.1 No Action

The no-action response is applicable to all operable units. The no-action response does not provide additional remediation, monitoring, or security activities at the site to further minimize risk to the environment or public health. NCP requires no action to be carried through detailed analysis of alternatives and therefore will not be eliminated at this stage. The no-action response will be further evaluated as a remedial action alternative for each of the three site operable units.

2.4.2 Access Restriction

The access restriction response is applicable to all operable units. This response will minimize access to and use of the areas of concern. It includes fencing and/or deed restrictions. The implementation of this response will also result in no changes to the existing site environment. If implemented properly, access restrictions provide moderate protection against direct contact with site contaminants. Access restriction will be retained for assembly into the alternatives.

2.4.3 Monitoring

The monitoring response is applicable for the ground water operable unit. This response evaluates the effectiveness of the collection/treatment systems for ground water. Monitoring wells, upgradient and downgradient, can be used to detect changes in contaminant releases from the site. Monitoring technique is simple to apply and is proven and reliable. Accordingly, it is carried forward for assembly into alternatives.

2.4.4 Surface Stabilization

This response is applicable to all operable units ~~except ground water~~ and includes dust and sediment control/barrier remedial technologies. These technologies can perform one of the following functions:

- Prevention of run-on/interception of runoff
- Prevention of infiltration
- Control of erosion
- Collection and transfer of water
- Storage and discharge of water
- Protection from flooding
- Dust minimization

Of the identified techniques for this response (capping, cofferdam, curtain barrier, and revegetation), capping and revegetation are the most practical techniques. These techniques may be used as support actions along with the alternatives developed in Chapter 3.0 for site remediation. These support technologies will not be individually screened; however, they will be evaluated with respect to the specific response actions for which they apply.

2.4.5 Containment

Containment response is applicable for all operable units. This response as a source control includes primarily in situ physical measures that restrict contaminant or waste movement or migration and minimize potential impacts on receptors. Major control and containment remedial technologies evaluated include horizontal barrier, vertical barrier, capping, surface water control, and ground water control systems.

Of the above technologies, horizontal barrier was eliminated from further evaluation due to the difficulty in determining the integrity of this type of barrier after construction. The remaining technologies are discussed in the following sections.

2.4.5.1 Vertical Barriers

Vertical barriers can be used to divert ground water flow away from a contaminant source area and isolate the source. Vertical barrier techniques considered for evaluation include (1) soil-bentonite slurry wall, (2) cement-bentonite slurry wall, (3) grout curtain, (4) steel sheet piles, and (5) vibrating beam wall. Slurry trenching is a means of placing a low permeability, subsurface, cutoff wall near a waste source to capture or contain resulting contamination and minimize ground water influx. Certain technologies are eliminated from further discussions due to difficulty in determining their integrity (grout curtain) and/or possibilities for leakage of ground water and improper construction (sheet piles, vibrating beam walls).

Cement-bentonite slurry walls are constructed in a manner similar to soil-bentonite slurry walls, except portland cement is mixed with the bentonite instead of soil. These walls are adaptable to more extreme topography and an extensive mixing area is not required. Cement-bentonite walls provide more structural strength than soil-bentonite walls; however, they are typically more permeable and resistant to fewer chemicals.

Soil-bentonite walls are composed of soil materials mixed with bentonite. Although soil-bentonite slurry wall construction requires a large work area for mixing and is restricted to relatively flat topography, the site is amenable to these requirements. In addition, soil-bentonite provides a lower permeability and is compatible with a wider range of wastes than other containment barrier techniques, including the cement-bentonite slurry wall.

The evaluation of the vertical containment barriers indicates that the soil-bentonite technique is more effective at this site than the cement-bentonite slurry wall technique. A soil-bentonite wall will be considered further in developing the remedial action alternatives.

2.4.5.2 Capping

This technology involves installation of a barrier over the surface of the contaminated area. Capping is designed to control erosion, prevent the generation of leachate due to surface water infiltration, and also alleviate possible direct and indirect exposures (via inhalation, ingestion, or dermal contact) to the wastes. Capping can be applied to the swamp and impoundment operable units. Capping techniques considered for evaluation include clay, asphalt, concrete, gravel clay, soil clay, soil synthetic liner, and soil synthetic liner clay caps.

Capping technique considered potentially favorable for containing the types of wastes and contaminants at the site is soil-synthetic liner-clay cap (Resource Conservation and Recovery Act [RCRA] type cap). Therefore, the RCRA-type cap is the only technique retained for further evaluation. RCRA-type caps prevent exposure and provide the most effective means of preventing surface water infiltration.

Remaining caps can be useful to a varying degree in minimizing direct human contact and water infiltration when properly constructed and maintained. However, due primarily to the physical state of the wastes and the potential for settlement, other caps may crack, allowing infiltration and exposure of wastes.

2.4.5.3 Surface Water Control

Surface water control can be used to minimize contamination of surface waters, reduce surface water infiltration, and reduce off-site transport of surface waters which have been contaminated. This technology includes use of diversion and collection systems, grading, and soil stabilization. These techniques will be retained as a support action for consideration in the development of remedial action alternatives. These techniques will be addressed further in Section 2.4.11, Support Actions.

2.4.6 Removal

Removal of waste material, by definition, is relative to impoundments and swamp materials. However, this technique is not applicable by itself but may be used in combination with other technologies. Detail of this technique is described in Section 2.4.11, Support Actions.

2.4.7 On- and Off-Site Landfill/Disposal

Landfilling is potentially viable for the impoundment and swamp operable units. Swamp waste with a concentration of polychlorinated biphenyls (PCBs) less than 500 milligrams per kilogram (mg/kg) can be disposed of at an on-site landfill. Disposal technologies include physical measures (other than in situ) which will provide a permanent preengineered environment to restrict contaminant or waste migration and minimize potential impacts on receptors. Off-site landfilling is considered to be practiced at existing facilities preapproved by the U.S. EPA and the respective state agency.

For this screening process, generally, landfilling has been defined as a preengineered disposal area designed to meet RCRA regulations. For CERCLA, site reconsolidation of untreated contaminated material on site is allowed as long as the material remains within the described area of contamination. Adequate open level areas exist at the site to construct a landfill above the floodplain. However, an unfavorable aspect of landfilling results from the excavation of waste and the potential increase in degree of short-term hazard caused by this disturbance of wastes.

2.4.8 On-Site Treatment

On-site treatment includes biological, thermal, chemical, and in situ measures which reduce the volume, toxicity, or mobility of a contaminant or waste by altering its physical or chemical properties. Applicable technologies are discussed in the following subsections as they apply to each of the operable units.

2.4.8.1 Biological

In situ biodegradation and on-site landfarming biological treatment were evaluated for the impoundments and swamp operable units. Both techniques involve enhancing the biodegradation of the organics within the waste or soil. However, because of the small volumes of wastes and low levels of organics, both techniques are considered inappropriate. Therefore, these techniques are eliminated from further discussions.

2.4.8.2 Solidification/Stabilization

Waste solidification (applicable to impoundment and swamp operable units) involves techniques designed to seal the wastes in a solid, stable mass and to reduce the mobility of wastes in the environment. Some of these techniques physically surround the waste particles with a solidifying agent. Others chemically fix the wastes in a reaction with the solidifier. The following solidification/stabilization techniques were reviewed for treatment of the waste material:

- Cement based
- Thermoplastics
- Organic polymer
- Glassification
- Lime based

+ swamp materials contaminated with less than 500 mg/kg PCBs.

These techniques typically are not used for PCB-contaminated materials; therefore, solidification techniques were considered for the impoundment materials. The cement-based process can be used to solidify a wide range of wastes with little or no pretreatment requirement. However, certain metals are liable to leach out after solidification. The lime-based process, which is similar to the cement-based, is considered applicable to the impoundment materials. Generally, this technique is amenable to inorganic wastes, but by including proprietary curing agents into the mix, the reaction between the lime and pozzolanic materials can be modified to solidify certain organic wastes also.

The other remaining techniques not retained for further consideration are more suitable for solidifying radioactive materials. Glassification has been restricted to radioactive or highly toxic wastes, but it is more expensive than incineration for PCB-contaminated materials. Thermoplastic solidification and organic polymer techniques are not feasible for the treatment of the PCB wastes and are less cost-effective than the lime-based for inorganic wastes present at the site. For this reason, lime-based solidification/stabilization is retained for treatment of the impoundment materials.

2.4.8.3 Physical/Chemical Treatment - Thermal

Thermal treatment is a process in which molecular bonding of organic or inorganic compounds is altered through thermal decomposition and oxidation. The end products of this process typically include carbon dioxide, element carbon, ionized halogen, phosphorus, sulfur, and other inorganics, depending upon the original composition of the material.

The mobilization and start-up costs of incineration are generally high. These large costs can be justified if the system is used to treat large volumes (approximately 25,000 tons) of waste. The site soil/sludge quantities are relatively small to justify any on-site incineration.

The incineration technology is technically unfeasible to treat the site ground water because of the low level of organics in the ground water. For these reasons, all on-site thermal techniques are eliminated from further consideration.

2.4.8.4 Physical/Chemical - In Situ Treatment

The following in situ treatment techniques were evaluated for the impoundment and swamp area operable units:

- Soil aeration
- Soil washing
- Injection/grouting
- Vitrification
- Solvent extraction

All of these techniques were eliminated because of the inability of the techniques to mitigate the migration of contaminants from the specific types of wastes which are known to exist at the site.

Soil aeration was eliminated due to the metal contamination in the wastes involved. In addition, soil washing and solvent extraction would be ineffective because excessively high amounts of fluids would be required because of the shallow water table.

Injection/grouting was eliminated because of the inability of the technique to react with the specific types of wastes which are known to exist at the site.

In situ vitrification (ISV), is still an emerging technology. The ISV process involves in-place conversion of contaminated soils into a stable crystalline waste form. The soil is melted by supplying electrical current to graphite electrodes inserted throughout the waste area. As the soil is heated, it becomes vitrified, and the organic constituents in the soil are pyrolyzed. High temperatures and long residence times result in complete combustion and/or destruction of the organic compounds. This technique is not applicable to these wastes because of the shallow water table.

The following in situ techniques are generally applicable to the ground water treatment and therefore were evaluated for the ground water ~~operable unit~~

- Permeable treatment beds
- Chemical dehydrochlorination
- Cultivation (stabilization)
- Injection/grouting (stabilization)

In general, the metal contamination of the ground water renders these techniques ineffective. Permeable treatment bed techniques are not applicable for the treatment of inorganic contaminants present in the ground water. Since chlorinated compounds are not prevalent, the chemical dehydrochlorination technique is also not applicable. The cultivation technique is not applicable because of low organic concentrations in the ground water. The injection/grouting technique is not applicable because of the inability to treat the site-specific waste. For these reasons, in situ physical/chemical treatment techniques were eliminated from further consideration.

2.4.9 Off-Site Treatment

Off-site treatment includes physical, chemical, and biological measures which will reduce the volume, toxicity, or mobility of a contaminant or waste by altering the physical or chemical properties. This portion of the screening presumes that these technologies exist at presently U.S. EPA-approved facilities.

2.4.9.1 Thermal

The most effective technique for destruction of PCB-contaminated material of the swamp area is off-site incineration at permitted facilities. For the impoundments materials containing metal contamination, incineration is not appropriate because metals primarily change to their oxidized form, which remains hazardous.

For these reasons, off-site incineration technology was retained for alternatives to treat the PCB-contaminated swamp materials.

2.4.9.2 Biological

Landfarming biological treatment is a viable technique for treatment of the swamp materials. The technique involves enhancing the biodegradation of the organic constituents within the waste or soil. Since no permitted commercial facility is known to exist, this technique was deleted from further consideration.

2.4.10 Support Actions

Several techniques have been defined as support actions rather than response actions in themselves. The following support actions were considered for this site:

- Storage
- Dust control
- Backfilling
- Grading
- Revegetation
- Dewatering
- Removal

The support actions may be applicable to all operable units. Specific techniques will not be chosen at this time; instead, detailed evaluations will occur during the conceptual design or design phase of the project.

2.4.10.1 Storage

Storage includes physical measures which will provide a temporary preengineered environment restricting contaminant or waste movement and minimizing potential impacts on a receptor. Possible storage methods may include storage in drums or in temporary, lined areas enclosed by embankments. Storage may be necessary during incineration or disposal operations.

2.4.10.2 Dust Control

Dust control is practiced in order to minimize the emissions of airborne particulates from working surfaces. Two techniques include the application of water or polymers to these surfaces. Dust control may be applicable for the excavation and capping operations.

2.4.10.3 Grading, Revegetation, and Backfilling

Grading and revegetation are components of surface water management. Grading is the general term for techniques used to reshape the surface of covered landfills in order to manage surface water run-on and runoff while controlling erosion. Backfilling is usually required during this reshaping process to fill in areas of lower elevation. Equipment used for grading and backfilling includes bulldozers, scrapers, front-end loaders, and compactors. Manipulation of slope length and gradient is the most common grading technique used to promote controlled runoff. At sites where effective caps have been applied, various techniques can be used to prepare the covered surface for revegetation. These techniques include scarification, tracking, and contour terracing, which create a roughened and loosened soil surface to aid in the establishment of the vegetation. Revegetation decreases erosion by wind and water and contributes to the development of a stable surface environment. Vegetative stabilization generally involves planting of grasses and legumes. Selection of suitable plant species depends on site-specific variables.

2.4.10.4 Dewatering

Dewatering is a method of removing water from solid-liquid materials. Dewatering may be a necessary ancillary operation for incineration or disposal actions, since some water is present in the impoundments and swamp areas and the water table intersects the southern impoundment and the contaminated soils. Applicable techniques include gravity drainage, filter presses, dewatering beds, screens, and centrifuges.

2.4.10.5 Removal

Complete or partial removal involves the excavation of contaminated materials and removal of these materials from the contaminated area. The removed material will be ultimately treated or disposed using one of the on- or off-site methods discussed previously. Removal techniques may include use of backhoes, cranes, front-end loaders, scrapers, drum grapplers, or forklifts.

2.4.11 Summary of Screened Remedial Technologies

Table 2.2 presents the technologies that have been retained for further evaluation and development of remedial action alternatives.

Applicable technologies for the impoundment operable unit include access restriction, ~~monitoring,~~ soil-bentonite-type slurry wall, soil-synthetic liner and clay cap, lime-based solidification/stabilization, and on- and off-site disposal.

Access restriction, slurry wall, on- and off-site disposal, and off-site incineration were the favored technologies for the remedy of the swamp operable unit.

The no-action response has been retained for each of the ~~three~~ operable units and will be considered as a remedial action alternative in the next phase of the feasibility study (FS).

3.0 DEVELOPMENT AND SCREENING OF REMEDIAL ACTION ALTERNATIVES

The Remedial Action Alternative Development and Screening Task (Tasks 7 and 8 of the Alsco-Anaconda NPL site FS work plan) involved the following:

- Assembling feasible remedial technologies (previously screened under Task 6) into a number of remedial action alternatives
- Developing criteria by which the assembled remedial action alternatives can be screened in regards to factors of effectiveness, implementability, and cost
- Applying the developed screening criteria to each remedial action alternative

This chapter summarizes and presents the results of the above-described requirements.

Remedial action alternatives will be developed that address the above-described components of the Alsco-Anaconda NPL site operable units and the related site-specific objectives.

3.1 REMEDIAL ACTION ALTERNATIVE DEVELOPMENT

Remedial action alternatives have been assembled by combining applicable and feasible technologies to form possible cleanup remedies for the Alsco-Anaconda NPL site. The technologies remaining from the screening process and used in this task are presented in Figures 2-3 and 2-4, respectively. The alternatives were developed to address the components of the Alsco-Anaconda NPL site operable units and related site-specific objectives. Guidance for this task was obtained from the following sources:

- NCP Code of Federal Regulations (CFR) Title 40, Part 300
- Section 121 of the Superfund Amendments and Reauthorization Act of 1986
- U.S. EPA, October 1988, Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA
- Clean Air Act, National Primary and Secondary Ambient Air Quality Standards
- Clean Water Act, Water Quality Criteria for Human Health, Fish, and Drinking Water

- Safe Drinking Water Act
  - National Primary and Secondary Drinking Water Standards
  - Proposed Maximum Contaminant Levels (MCLs), Recommended Maximum Contaminant Levels (RMCLs) (now referred to as the Maximum Contaminant Level Goals [MCLGs]), and proposed guidance levels
- U.S. EPA Ambient Standards and Criteria for Superfund Remedial Sites
- U.S. EPA Superfund Public Health Evaluation Manual
- State of Ohio Air and Water Quality Standards
- Hazardous and Solid Waste Amendments to the Resource Conservation and Recover Act
- Occupational Safety and Health Administration Standards and Criteria
- Local Public Health Standards

Federal, state, and local public health and environmental standards contained in the above-mentioned sources were considered in the remedial action alternative development. Also, as recommended by the U.S. EPA Guidance Document and the NCP, acceptable engineering practices, as related to site-specific conditions, were considered during remedial action alternative development.

Since the concentration of PCBs is a limiting factor for certain treatment technologies, the swamp materials are divided into three broad categories as follows:

CATEGORIES	PCB CONCENTRATION RANGE (mg/kg)
• Hot material	>500 ppm
• Moderate material	>50 but <500
• Low material	>25 but <50

As a result of the above factors and information, ~~17~~ 9 (no action, plus eight additional alternatives ~~subdivided into A and B alternatives~~) remedial action alternatives have been assembled and are identified by one of the following categories:

- No action
- Containment option which includes little or no treatment, but provides protection for human health and the environment
- Treatment options which range from that which eliminates, to the extent possible, the need for long-term management at the site to that which reduces the toxicity, mobility, or volume of contaminants

These alternatives are presented in Table 3-1. Alternative 1 is a no-action alternative and Alternatives 2 through 9 combine both containment and treatment. The following paragraphs described the major components of each remedial action alternative.

Alternative 1 - No Action

The no-action alternative provides no additional remediation and will result in no changes to the existing site environment. However, it includes a security fence, deed restrictions~~, and ground water monitoring~~. Any changes to the existing environment will occur only as a result of natural occurrences. No action does not satisfy the remedial action goals, and does not comply with the Applicable or Relevant and Appropriate Requirements (ARARs). This alternative will be considered as a baseline for comparison with other alternatives where remedial action will be performed. The principal components of this alternative are described below.

A site fence is installed (8 feet high and approximately 2,000 feet long) to limit human exposure via direct contact with the waste. In addition, this alternative involves use restrictions to control future use of the site.

~~The ground water will be monitored for indicator parameters to ensure and document that future ground water contaminant levels do not pose a threat to the public health or the environment.~~

Tu 1

Alternative 2 - Consolidate/Cap Impoundment[2], Incinerate Hot Swamp Materials,[3] Slurry Wall/Cap Swamp; Flood Berm; and Monitor Ground Water

In this alternative, the southern and northern impoundment wastes are excavated and redeposited in the same general area in a lined impoundment. A minimum of five feet of separation is provided between the ground water and the waste. Additionally, the impoundment is lined with a liner system which meets RCRA landfill requirements. The impoundment will be capped, which also meets RCRA criterion. The hot swamp material (containing greater than 500 milligrams per kilogram [mg/kg] polychlorinated biphenyl [PCB]) is excavated and transported off site to a facility permitted to incinerate PCB waste. The remaining swamp area is capped using a RCRA-type cap and the construction of a slurry wall is constructed around the entire swamp area. In addition, a berm (10 feet high by 700 feet long) will be constructed along the Tuscarawas River for flood prevention at this site. This will prevent a 100-year flood from reaching the waste materials which will remain on site.

The impoundment materials are consolidated in two stages. First the waste materials at the southern impoundment (1,860 cubic yards) are excavated and temporarily stockpiled on the northern impoundment area. The surface of the stockpile will be covered with a foam capable of suppressing the dust during the storage period. The southern impoundment excavation area is raised using four feet of borrow and prepared using a double liner meeting the RCRA landfill requirements. The layers of this liner from bottom to top include a 2-foot layer of clay, a layer of 60-mil high density polyethylene (HDPE) synthetic membrane, a layer of drainage net for secondary leak detection, another layer of 60-mil HDPE, 1-foot layer of sand for collection of leachates, 4-inch PVC pipe in a sand layer, and a layer of filter fabric. This construction places the top of the liner five feet above the water table. After installation of the double liner, the temporarily stockpiled southern impoundment material will be transferred back to the southern impoundment area.

[2]Impoundment includes the southern and northern impoundments and the sludge pit.

[3]This material incorporates the PCB contaminated F019 sludge which has a PCB concentration greater than 500 milligrams per kilogram (mg/kg).

The second stage of consolidation effort involves excavation of waste materials at the northern impoundment and earthen berm divider (2,190 cubic yards), temporary stockpiling of this material at the southern impoundment area, and construction of the southern impoundment double-liner system. Suppressant foam will be used to cover the stockpile for dust prevention as well as to prevent surface erosion from rain. The southern liner system will be expanded to the northern impoundment. Once the northern impoundment is lined, the excess material stored in the southern impoundment will be properly distributed over the entire (northern and southern) impoundments. The entire impoundment will be capped using a RCRA-type cap. The RCRA-type cap includes a 2-foot layer of clay, a layer of 60-mil HDPE synthetic membrane, a layer of drainage net, a layer of filter fabric, 18 inches of soil, 6 inches of topsoil, and vegetation.

The hot swamp material (approximately 50 cubic yards containing greater than 500 mg/kg of PCB) is excavated, drummed, and transported to a facility licensed for incineration of PCB. The remaining swamp area is contained by constructing an approximately 25-foot-deep slurry wall around the entire perimeter. Due to the presence of only trace amounts of silts and a bedrock elevation greater than 250 feet beneath the site, a hanging slurry wall is constructed. The slurry wall coupled with the ground water extraction wells inside the slurry wall will maintain separation between the swamp waste and the ground water. In addition, the area will be covered with a RCRA-type cap to prevent further infiltration of precipitation into the waste and to limit the potential for human exposure to site constituents via direct contact.

A berm (10 feet high and 700 feet long) will be installed along the Tuscarawas River for flood prevention at this site. The berm extends between the two high points located west and south of the site property boundaries. This will prevent a 100-year flood from reaching the waste materials which will remain on site.

Fencing and deed restriction components of this alternative are the same as Alternative 1.

Site contamination migrating from the site will be monitored to confirm that these concentrations improve with time and do not exceed acceptable limits.

Alternative 3 - Off-Site Treatment/Disposal Impoundment, Incinerate Hot Swamp Material, Off-Site Treatment/Disposal of Remaining F019 Sludge in Swamp~~, and Monitor Ground Water~~

This alternative is a combination of treatment and source control/management. It includes total removal of impoundment materials to cleanup levels for the F019 sludge, treatment, and disposal at a permitted off-site facility; incineration of hot swamp materials at a licensed facility for PCB incineration; and removal of the remaining F019 sludge in the swamp to cleanup levels,[4] treatment, and disposal at a permitted off-site facility. In addition, the excavated areas of the impoundment will be backfilled with clean borrow (5,600 cubic yards). Excavation of all waste materials for off-site treatment and/or landfilling will eliminate the contamination sources from the site. Additionally, it will eliminate the potential risks to humans and the environment at the site. Therefore, this alternative satisfies the remedial action goals by eliminating the contamination sources at the site and reducing exposure to PCB-contaminated soils by incineration. The principal components of this alternative are described below.

All the F019 sludge in the southern and northern impoundments and sludge pit (5,570 cubic yards) will be excavated to cleanup levels ~~(F019)~~ and hauled to a permitted landfill/reclamation-reuse facility. This will eliminate the source for potential ground water contamination at the impoundment areas. Adequate treatment will be accomplished by stabilization/solidification of the heavy metals and by an oxidation process for destruction of cyanides within the waste material. Due to the limited quantity of wastes, on-site treatment of the excavated materials prior to off-site transportation is not warranted; therefore, the waste material will be treated at the off-site facility. The excavated materials will be dewatered, if required. The dewatering process may consist of simply placing the wastes on an engineered pad or use of a mechanical (vacuum, filter press, or belt press) dewatering system.

[4]~~The F019 sludge contaminated with PCBs greater than 25 mg/kg but less than 500 mg/kg.~~

Similar to Alternative 2, the hot swamp materials (50 cubic yards) will be excavated, drummed, and transported off site for incineration. However, the remaining swamp materials (3,250 cubic yards) will be excavated to the F019 cleanup levels and transported to a permitted landfill. The F019 waste will be pretreated to acceptable levels for disposal at the off-site facility.

Other components of this alternative ar~~e the same as Alternative 2 except that, since all site waste is removed, flood protection is not required. These components include security measures, use restrictions on future development of the site,~~ surface water management system~~and monitoring of the site.~~

<u>Alternative 4 - Off-Site Treatment/Disposal Impoundment, Incinerate F019 Sludge in Swamp~~, and Monitor Ground Water~~</u>

This alternative is a combination of treatment and source control/management. It is essentially the same as Alternative 3, except the remaining F019 sludge with PCB concentrations lower than 500 mg/kg within the swamp will also be incinerated rather than treated/landfilled. All swamp waste (3,300 cubic yards) will be excavated, properly containerized, and transported off site to a facility licensed for incineration of PCB. The swamp area will be regraded using the remaining uncontaminated soils to minimize any surface water ponding.

Other components of this alternative are the same as Alternative 3. These components include (1) excavation of all F019 sludge (5,570 cubic yards) to cleanup levels at the impoundment, treatment, and disposal at a permitted disposal/reclamation-reuse landfill, (2) backfilling of the impoundment excavated area with clean borrow, (~~3) ground water monitoring, (4) fencing and use restrictions, (~~~~5~~3) diversion and collection systems for management of surface water, and (~~6~~4) activities after site closure.

This alternative satisfies the remedial action goals by eliminating the contamination sources at the site and minimizing the exposure to the F019 sludge which is contaminated with PCB by detoxification and volume reduction using the incineration technique.

Alternative 5 - On-Site Treatment/Landfill Impoundment, Incinerate Hot Swamp Material, Off-Site Treatment/Disposal of Remaining F019 Sludge in Swamp, and Monitor Ground Water

This alternative is a combination of treatment and source control/management. This alternative applies the technologies in Alternative 3 except that it uses an on-site instead of an off-site landfill to dispose of the treated impoundment waste. The hot swamp material, containing greater than 500 mg/kg PCB, will be incinerated in an off-site permitted facility. As in Alternative 3, the low- and moderate-level PCB-contaminated swamp material will be excavated and transported off site to a permitted disposal facility. The waste will be pretreated off site to standards permitted for disposal of F019-type waste into the landfill prior to disposal.

This alternative satisfies the remedial action goals by managing the contamination sources after partial detoxification at the site and minimizing exposure to PCB-contaminated soils by detoxification and volume reduction using incineration techniques.

The waste materials will be mixed with a solution of sodium hypochlorite for the oxidation/destruction of cyanides. Mixing will be performed in a rotary mixing tank(s) similar to cement mixing trucks. After the completion of oxidation treatment in the mixing tank, the waste material will be mixed with adequate quantities of stabilizing/solidifying agents required for the lime-based solidification technique. Solidification results in the production of monolithic block binding. Therefore, significant heavy metal reduction in solubility, mobility, and structure permeability will be achieved. The quantitative and qualitative specifications for oxidation and stabilization will be defined during a treatability study program required prior to implementation of this alternative. The treated materials will then be placed inside the RCRA ~~vault~~ landfill. The exposed surface of materials is covered with foam for suppressing dust during this storage period until capping of the ~~vault~~ landfill is initiated. All excavated areas within the site will be backfilled with clean borrow and revegetated.

The RCRA vault ~~will~~ landfill be constructed meeting the RCRA standards for disposal of hazardous materials. It will contain primary clay plus a synthetic membrane composite liner and a secondary synthetic membrane liner. In addition, it will be constructed with a leak detection system and leachate collection system. The landfill will be capped using a RCRA-type multilayer capping system. The cap will include a clay liner; synthetic liner; flow zone (drainage net and geotextile fabric); and 18 inches of soil, 6 inches of topsoil, and vegetation.

Other components of this alternative are the same as Alternative 3. These components include (1) excavation, drumming, hauling, and incineration of hot swamp materials (50 cubic yards) at the a permitted facility; (2) excavation, hauling, treatment, and disposal of remaining swamp F019 sludge (3,250 cubic yards) at a permitted disposal facility; ~~(3) ground water monitoring,~~ ~~(4) fencing and deed restrictions;~~ (5) diversion and collection systems for management of surface water; and (6) activities after site closure including maintenance of the on-site RCRA v~~ault facility~~.

Alternative 6 - On-Site Treatment/Landfill Impoundment, Incinerate Swamp Materials, and Monitor Ground Water

This alternative is a combination of treatment and source control/management. In this alternative, the impoundment material is remediated in the same manner as Alternative 5 but differs in the handling of the swamp material. All of the swamp waste material is incinerated off site in a facility permitted to handle PCB waste. This alternative satisfies the remedial action goals by either containing the contamination sources at the site or by eliminating exposure to PCB-contaminated soils by detoxification and volume reduction using incineration techniques.

On-site treatment/landfilling of the impoundment materials (5,570 cubic yards) is performed as described in Alternative 5. Similar to Alternative 4, all the swamp materials (3,300 cubic yards) are excavated to the cleanup levels for the F019 sludge, containerized (as required), hauled, and incinerated at a permitted facility.

Other components of this alternative are also similar to Alternative 5. These components include (1) ground water monitoring, (2) fencing and use restrictions, (3) diversion and collection systems for management of surface water, and (4) activities after site closure.

Alternative 7 - Consolidate/Cap Impoundment, Incinerate Swamp Materials, and Monitor Ground Water

This alternative is considered a combination of both containment and treatment with source control/management. In this alternative, the impoundment materials are contained as described in Alternative 2. In addition, the swamp materials are treated as described in Alternative 4. This alternative satisfies remedial action goals of preventing contaminated surface and ground water entering the Tuscarawas River and reducing exposure to PCB contaminated soils by incineration in an incineration facility. It also addresses the goal of flood prevention with the use of an earthen berm.

As described in Alternative 2, southern and northern impoundments and the earthen berm divider (5,570 cubic yards) are consolidated in a two-stage effort and capped along with the sludge pit. In addition, a 700 feet of berm will be installed for flood protection. Also, similar to Alternative 4, all swamp materials (3,300 cubic yards) are excavated to cleanup levels, properly containerized, hauled, and incinerated at a permitted facility.

Other components of this alternative are the same as Alternative 2. These components include (1) ground water monitoring, (2) fencing and use restrictions, (3) diversion and collection systems for management of surface water, and (4) activities after site closure.

Alternative 8 - Consolidate/Cap Impoundment, Incinerate F019 Sludge Above PCB Cleanup Level, Off-Site Treatment/Disposal of Remaining F019 Sludge in Swamp, and Monitor Ground Water

This alternative is considered a combination of both containment and treatment with source control/management. It is the same as Alternative 7, except for the volume of swamp material being incinerated. In this alternative, the swamp materials with PCB concentrations above the PCB cleanup level will be incinerated and the remaining waste (F019 sludge below PCB cleanup levels) will be transported to a permitted disposal facility for treatment and disposal.

Impoundment materials (5,570 cubic yards) will be consolidated and capped with the sludge pit as described in Alternative 2. Swamp materials with PCB concentrations above the cleanup level of 25 ppm (approximately 1,300 cubic yards) will be excavated, containerized (as required), transported, and incinerated at a permitted incineration facility. Remaining swamp F019 materials are excavated to cleanup levels for the F019 sludge (2,000 cubic yards), hauled, treated, and disposed of at a permitted disposal facility as described in Alternative 2.

Other components of this alternative are the same as Alternative 7. These components include (1) ground water monitoring, (2) fencing and use restrictions, (3) diversion and collection systems for management of surface water, and (4) activities after site closure.

In this alternative, remedial action goals are satisfied by eliminating the impoundment waste from coming in contact with surface water and ground water, thereby preventing any mechanism for leaching waste constituents into the surface water and ground water. The swamp waste source is removed from the site which eliminates any potential transfer of contaminants to the river. The swamp material containing PCB exceeding the cleanup levels is destroyed by incineration. The remaining F019 swamp material is pretreated to meet applicable RCRA standards prior to disposal.

<u>Alternative 9 - On-Site Treatment/Landfill Impoundment, Incinerate Hot Swamp Materials, On-Site Treatment/Landfill Remaining F019 Sludge in Swamp, and Monitor Ground Water</u>

This alternative is the same as Alternative 5 (a combination of treatment and source control/management), except for the remediation of the swamp materials. The swamp F019 materials after removal of the hot material will be treated and disposed of on site within a RCRA ~~-type vault~~ landfill instead of off site.

On-site disposal of the impoundment materials (5,570 cubic yards) and incineration of hot swamp materials (50 cubic yards) at a permitted incineration facility are described in Alternative 5. Remaining F019 sludge within the swamp (3,250 cubic yards) will be treated similar to impoundment the materials and disposed of within the on-site RCRA ~~vault~~ landfill but in a separate cell.

The majority of components of this alternative are the same as Alternative 5. These components include (1) excavation, containerizing, transporting, and incineration of hot swamp materials (50 cubic yards) at a permitted incineration facility, (2) treatment and disposal of impoundment waste and the remainder of swamp waste material in an on-site RCRA-type landfill ~~vault facility,~~ (3) ground water monitoring, (4) fencing and deed restrictions, (5) diversion and collection systems for management of surface water, and (6) activities after the site closure.

3.2 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES SCREENING CRITERIA

The purpose of the screening is to further reduce the number of alternatives that will be subjected to detailed analysis as part of the next task (Task 9). While the alternative screening is more general than the subsequent detailed analysis, it will be sufficiently detailed to distinguish significant advantages or disadvantages among the alternatives. A key distinction between the screening and the subsequent detailed analysis of alternatives is that during screening, the emphasis in comparison will be between similar alternatives, with the most promising carried forward for further analysis while the detailed analysis will be used for comparisons among all alternatives.

Each alternative was given a preliminary evaluation for its expected ability to meet or exceed criteria from three general categories: effectiveness, implementability, and cost. The specific screening elements derived from the three general screening categories include the following:

- Effectiveness - A key aspect of the screening evaluation is the effectiveness of each alternative in protecting human health and the environment. This screening criterion includes the evaluation of each alternative as to the protectiveness it provides and the reductions in toxicity, mobility, or volume it achieves.

  - Short-term protectiveness of human health - Rating of effectiveness in minimizing the potential of adverse human health effects caused by exposure during construction or implementation. Both on- and off-site exposures are considered under this criterion. Exposure pathways include air, water, and dermal contact.

  - Long-term protectiveness of human health - Rating of effectiveness in minimizing the potential of adverse human health effects caused by exposure after the remedial action is complete. The ability of an alternative to minimize future exposures is considered under this criterion. Exposure pathways include air, water, and dermal contact.

- Short-term protectiveness of the environment - Rating of ability to alleviate the potential of surface water, ground water, and air contamination during remedial action alternative implementation.

- Long-term protectiveness of the environment - Rating of ability to alleviate surface water, ground water, and air contamination.

- Reduction of mobility, toxicity, or volume of waste - Rating of an alternative effectiveness in changing one or more characteristics of the hazardous substances or contaminated media by the use of treatment to decrease the threats or risks associated with the hazardous material.

• Implementability - Implementability is a measure of both the technical and administrative feasibility of constructing, operating, and maintaining a remedial action alternative. The screening criterion is used to evaluate the combination of process options with respect to site-specific conditions.

  - Technical feasibility - Rating of the ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete; it also includes operation and maintenance (O&M), replacement, and monitoring of technical components of the alternative, if required, after the remedial action is complete.

  - Administrative feasibility - Rating of the ability to obtain approvals from other offices and agencies; the availability of treatment, storage, and disposal services; and the requirements for, and availability of, specific equipment and technical specialists.

• Costs - Both capital and O&M will be considered during the screening of alternatives. The evaluation should include those O&M costs that will be incurred for as long as necessary, even after the initial remedial action is complete. Likewise, potential future remedial action costs should be considered during alternative screening to the extent they can be defined.

Rating Criteria

The alternatives were evaluated by applying a simple numeric rating system to each criterion, with the exception of the cost criterion. Each screening criterion is assigned a rating value ranging between 1 and 5, relative to each component of each alternative. The rating value assignments were based on both experience and the overall characteristics of the components. If a specific criterion was considered unfavorable for a given component of a remedial action alternative, a rating value of 1 was assigned to that criterion for the component. Likewise, if a particular screening criterion was considered favorable, a rating value of 5 was assigned to that screening criterion for that specific remedial action alternative component. Rating scores of 2 through 4 were given to distinguish between varying degrees of unfavorable and favorable criteria. The total scores for each alternative will be determined by summing the screening criteria values assigned to each component. This evaluation process is presented in Table 3.2.

Cost estimates were prepared for each alternative and were used for comparison of competing alternatives (i.e., costs were used to differentiate among treatment alternatives but not between treatment and containment alternatives). The objective of the cost screening was to eliminate remedial action alternatives whose cost greatly exceeds that of other alternatives but which does not provide greater environmental, public health, or engineering benefits.

3.2.1 Effectiveness and Implementability Screening

Alternative 1 - No Action

The no-action alternative received a moderate score for overall effectiveness. This alternative received a moderate score primarily because there is relatively no remediation occurring at the site. The threat of release of contaminants to the Tuscarawas River will always exist. Since the PCB contamination source is Aroclor 1254, the threat of oral and dermal exposure will exist since the toxicity of this material will never decrease over time. The waste materials will always remain on site in Alternative 1 (no action); therefore, the reduction of mobility, toxicity, or volume of the wastes will not occur.

Several criteria pertaining to the implementability of the no-action alternative were given favorable ratings for ~~all three~~ the operable units. These ratings were based on the rationale that in the absence of any action, no problems are associated with constructibility or availability.

The OEPA does not allow waste materials to be left in a floodplain ~~unless the water can be diverted from entering this area.~~ There will be difficulty in acquiring the OEPA approval for allowing this waste material to remain since there are other feasible alternatives discussed further in this chapter. However, the need for use of an appropriate technology in the future is possible with an uncontrolled system; therefore, the administrative criterion was given a relatively lower rating.

Alternative 2 - Consolidate/Cap Impoundment, Incinerate Hot Swamp Materials, Slurry Wall/Cap Swamp, Flood Berm, and Monitor Ground Water

This alternative results in the potential for short-term adverse impacts on human health and the environment. These impacts are caused by dispersion and volatilization of contaminants during excavation and transportation of the waste materials. Also, impact will include possible inhalation and ingestion of airborne soil particles and dermal contact with contaminated soils during the installation of the slurry wall within the swamp area.

The removal and incineration of the F019 sludge contaminated with PCBs greater than 500 mg/kg received a favorable score for long-term protection of human health and environment. ~~Since treatment of ground water will not occur, the potential~~ for long-term protectiveness of human ~~health and the environment~~ for this operable unit was given a less than favora~~ble rating.~~ Potential leaching of contaminants from the waste material may occur in the future.

Since ~~ground water will not be treated, this operable unit was given an unfavorable~~ rating for ~~the reduction~~ of mobility, ~~toxicity, or volume~~ of waste criteria. Additionally, the slurry wall was given a moderate score for long-term protectiveness due to the uncertainties concerning this technology in the future.

Since the removal and incineration of the F019 sludge contaminated with PCBs greater than 500 mg/kg, this alternative has received a favorable score for the reduction of mobility, toxicity, or volume of waste criteria. Since the impoundment waste is not treated, it received a very low score for reduction of mobility, toxicity, and volume. In ~~addition, ground water received~~ a favora~~ble score in this criteria due to the treatment of the contaminated ground water at the site.~~

Alternative 2 received an overall moderate rating regarding implementability. Few problems are expected in the area of constructibility, but problems could occur concerning the availability of permitted facilities for the F019 sludge contaminated with PCBs greater than 500 mg/kg. In addition, the uncertainties related to the potential future failure of the slurry wall could result in a replacement for this portion of this alternative in the future.

Alternative 3 - Off-Site Treatment/Disposal Impoundment, Incinerate Hot Swamp Material, Off-Site Treatment/Disposal of Remaining F019 Sludge in Swamp~~, and Monitor Ground Water~~

This alternative results in the potential for short-term adverse impacts on human health and the environment. These impacts are caused by dispersion and volatilization of contaminants during excavation and transportation of the waste materials off site.

The long-term protectiveness of human health and the environment were assigned favorable ratings since the waste material will be removed from the site. ~~Since treatment of ground water will not occur, the potential for long-term protectiveness of human health and the environment from this operable unit was given a less than favorable rating.~~ The source of contamination will be removed and that would eliminate the potential for further degradation of ground water.

Alternative 3 was given a less than favorable rating for the reduction of waste since a major portion of the waste material is not being completely treated but rather disposed at an off-site facility. ~~The reduction of mobility, toxicity, or volume criterion for the ground water unit received a low score.~~

The implementability criteria were rated above average for this alternative. However, the process of finding a facility in compliance with the CERCLA off-site policy makes the availability criterion unfavorable for the impoundment and swamp operable units.

Alternative 4 - Off-Site Treatment/Disposal Impoundment, Incinerate F019 Sludge in Swamp~~, and Monitor Ground Water~~

This alternative results in the potential for short-term adverse impacts on human health and the environment. These impacts are caused by dispersion and volatilization of contaminants during excavation and transportation of the waste materials.

A favorable rating for long-term protectiveness of human health and the environment is the result of the removal of the source of contamination from the site. ~~Since treatment of ground water will not occur, the potential for long-term protectiveness of human health and the environment was given a less than favorable rating.~~

Incineration of the swamp waste material reduces the mobility, toxicity, and volume of the waste; therefore, this alternative has an above-average rating. A moderate score for this criterion was given to the impoundment waste since, prior to land disposition, the waste was somewhat treated for metals and cyanides.

The implementability criteria were rated favorably for this alternative. Approvals for continuously reliable incineration and the uncertainties of landfills in the future are the expected problem areas.

Therefore, a slightly less than favorable score was given for the implementability of the swamp waste and a moderate score was given for impoundment waste.

Alternative 5 - On-Site Treatment/Landfill Impoundment, Incinerate Hot Swamp Material, Off-Site Treatment/Disposal of Remaining F019 Sludge in Swamp, and Monitor Ground Water

The ratings given to the operable units for effectiveness and implementability are the same as those given in Alternative 3 except for the short-term protectiveness of human health and environment of the impoundment waste. These criteria received a moderate score because the waste was not transported off site. ~~Since treatment of ground water will not occur, the potential for long-term protectiveness of human health and the environment was given a less than favorable rating.~~

<u>Alternative 6 - On-Site Treatment/Landfill Impoundment, Incinerate Swamp Materials, and Monitor Ground Water</u>

This alternative is similar to Alternative 5 for the impoundment operable unit and Alternative 4 for the swamp operable unit. The rationale for scores is discussed in the appropriate sections. ~~Since treatment of ground water will not occur, the potential for long-term protectiveness of human health and the environment was given a less than favorable rating~~.

<u>Alternative 7 - Consolidate/Cap Impoundment, Incinerate F019 Sludge in Swamp Material, and Monitor Ground Water</u>

This alternative is similar to Alternative 2 for the impoundment operable unit and Alternative 4 for the swamp operable unit. The scoring and rationale for it are discussed under those alternatives. ~~Since treatment of ground water will not occur, the potential for long-term protectiveness of human health and the environment was given a less than favorable rating.~~

<u>Alternative 8 - Consolidate/Cap Impoundment, Incinerate F019 Sludge Above PCB Cleanup Level, Off-Site Treatment/Disposal of Remaining F019 Sludge in Swamp, and Monitor Ground Water</u>

This alternative is similar to Alternative 2 for the impoundment operable unit and Alternative 3 for the swamp operable unit. The scoring rationale is the same as that discussed under those alternatives. ~~Since treatment of ground water will not occur, the potential long-term protectiveness of human health and the environment was given a less than favorable rating~~.

<u>Alternative 9 - On-Site Treatment/Landfill Impoundment, Incinerate Hot Swamp Material, On-Site Treatment/Landfill Remaining F019 Sludge in Swamp, and Monitor Ground Water</u>

This alternative results in the potential for short-term adverse impacts on human health and the environment. These impacts are caused by dispersion and volatilization of contaminants during excavation, treatment, and transportation of the waste materials.

The removal and containment/incineration of the waste materials received favorable ratings for long-term protectiveness of human health and the environment, because the waste is either removed or partially treated and properly contained.

This alternative reduces the mobility, toxicity, or volume of the waste during incineration. Since some of the waste materials are left on site in a RCRA ~~type vaul~~t, the integrity of the ~~vault~~ in the future is uncertain. Therefore, only a moderate rating was assigned to this criterion.

Since only a portion (relatively more contaminated) of swamp waste is incinerated, a slightly less than favorable score was given for the swamp waste. A similar score was given for impoundment wastes because they were partially treated prior to landfilling. ~~The ground water was treated, and therefore it received a favorable score~~. The implementability criteria were rated favorably for the impoundment and swamp unit. ~~Since treatment of ground water will not occur, the potential for long-term protectiveness of human health and the environment was given a less than favorable rat~~ing.

3.3.2 Cost Summary

Table 3-3 shows the capital costs and actual operating and maintenance costs for each alternative. Present worth values were then calculated assuming a 10 percent interest rate and a 5 percent inflation rate. The calculations do not include provisions for taxes or depreciation. All capital investments were assumed to take place in the first year, and long-term annual costs were assumed to take place for 30 years.

3.3.3 Conclusions and Summary of Remedial Action Alternative Screening

Conclusions were made with the stipulation that at least one alternative from each protection category (such as no action, containment and treatment) must be retained for detailed analysis. Alternative 1 is the "no-action" alternative. The major actions for Alternatives 2 through 5 and 9 involve a combination of both treatment and containment actions.

Results of the effectiveness and implementability screening indicate that all 9 ~~17~~ alternatives except for No. 1 (no action) are generally favorable in most categories evaluated. While some alternatives contain specific and varying degrees of problems associated with effectiveness and implementability, as detailed in Section 3.3.1, none of the alternatives are unfavorable overall. Based on this preliminary screening, all alternatives, with the exception of no action, appear to provide adequate long-term protection of human health and environment, which is an important goal of remedial actions. In order to provide a range, but also a reasonable number of alternatives, the alternative receiving the highest scores in each protection category were retained for detailed analysis.

The containment alternative which received the highest score was Alternative 2. Since the scoring of Alternatives 3, 4, 5, and 6 was reasonably close, these alternatives have been retained for further analysis. ~~The addition of ground water treatment for these alternatives provides greater effectiveness for protecting human health and the~~ environment, in meeting ARARs, ~~in reducing the mobility, toxicity, and volume~~ of waste.

In the category which combines both treatment and contamination, Alternative 9 was retained for further evaluations.

Since the removal of the source of contamination ~~containment~~ occurs during Alternatives 3, 4, 5, 6, and 9, ~~monitoring for a period of time after remediation should occur to determine if~~ ground water ~~treatment is actually required~~. ~~With source removal, the quality of the ground water will improve over time.~~

In summary, the following remedial action alternatives have been retained for detailed analysis:

- Alternative 1 - No action
- Alternative 2 - Consolidate/cap impoundment, incinerate hot swamp materials, slurry wall/cap swamp, flood berm, and monitor ground water
- Alternative 3 - Off-site treatment/disposal impoundment, incinerate hot swamp materials, off-site treatment/disposal of remaining F019 sludge in swamp~~, and monitor ground water~~
- Alternative 4 - Off-site treatment/disposal impoundment, incinerate F019 sludge in swamp~~, and monitor ground water~~
- Alternative 5 - On-site treatment/landfill impoundment, incinerate hot materials in swamp, off-site treatment/disposal of remaining F019 sludge in swamp, and monitor ground water

- Alternative 6 - On-site treatment/landfill impoundment, incinerate swamp materials, and monitor ground water
- Alternative 9 - On-site treatment/landfill impoundment, incinerate hot swamp materials, on-site treatment/landfill remaining F019 sludge in swamp, and monitor ground water

4.0 DETAILED DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

The seven alternatives considered for detailed analysis include the following:

- Alternative 1 - No action
- Alternative 2 - Consolidate/cap impoundment, incinerate hot swamp materials, slurry wall/cap swamp, flood berm, and monitor ground water
- Alternative 3 - Off-site treatment/disposal impoundment, incinerate hot swamp materials, off-site treatment/disposal of remaining F019 sludge in swamp~~, and monitor ground water~~
- Alternative 4 - Off-site treatment/disposal impoundment, incinerate F019 sludge in swamp~~, and monitor ground water~~
- Alternative 5 - On-site treatment/landfill impoundment, incinerate hot materials in swamp, off-site treatment/disposal of remaining F019 sludge in swamp, and monitor ground water
- Alternative 6 - On-site treatment/landfill impoundment, incinerate F019 sludge in swamp, and monitor ground water
- Alternative 9 - On-site treatment landfill impoundment, incinerate hot swamp materials, on-site treatment/landfill remaining F019 sludge in swamp, and monitor ground water

The following section describe the major components of each remedial alternative.

4.1 ALTERNATIVE 1 - NO ACTION

The no-action alternative provides no additional remediation and will result in no changes to the existing site environment. Any changes to the existing environment will occur only as a result of natural occurrences. No action does not satisfy the remedial action goals and does not comply with the ARARs. This alternative will be considered as a baseline for comparison with other alternatives where remedial action will be performed. The principal components of this alternative are ~~as follow:~~

- ~~Restrictions~~
- ~~Ground water monitoring~~

Details for each component are described below.

4.1.1 Restrictions

A site fence is installed (8 feet high and approximately 1,000 feet long) along the site's property lines excluding the riverbank. The fence is not installed along the riverbank because of the maintenance problems associated with flood damage. Restriction signs are used along the toe of the site embankment to alert potential intruders not to trespass onto the site.

Deed restrictions will be used to control future property use.

4.1.2 Ground Water Monitoring

Contaminant concentrations leaving the site will be monitored to determine that these concentrations do not exceed acceptable limits. Upgradient and downgradient monitoring wells will be used for this monitoring.

4.2 ALTERNATIVE 2 - CONSOLIDATE/CAP IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, SLURRY WALL/CAP SWAMP, FLOOD BERM, AND MONITOR GROUND WATER

This alternative is a combination of containment and source control/management. With the exception of the hot swamp materials (containing greater than 500 milligrams per kilogram [mg/kg] polychlorinated biphenyl, [PCBs]), all the materials remain in place. The major components of this alternative include the following:

- Consolidate/cap impoundment
- Incinerate hot swamp materials
- Slurry wall/cap swamp
- Flood berm
- Monitor ground water
- Restrictions

A plan view of this alternative and a typical cross section are shown in Figures 4-1 and 4-2, respectively. Details for each component are described below.

4.2.1 Consolidate/Cap Impoundment

Wastes contained in the bottom two-foot layer of the southern and northern impoundments are the only wastes in contact with the ground water. In order to minimize the ground water contact with wastes, the bottom of the impoundment will be raised five feet above the ground water table.

The southern and northern impoundment wastes (3,610 cubic yards) including the earthen divider berm (440 cubic yards) are excavated and redeposited in the same general area in a lined impoundment. A minimum of five feet of separation is provided between the ground water and the waste. Additionally, the impoundment is lined with a liner system which meets RCRA landfill requirements. The impoundment will be capped, which also meets the RCRA criterion. Details of the cross section concerning the southern and northern impoundments after the consolidation of wastes are shown in Figure 4-3. Details concerning a typical RCRA-type cap are shown in Figure 4-4.

The impoundment materials are consolidated in two stages. First the waste materials at the southern impoundment (1,860 cubic yards) are excavated and temporarily stockpiled on the northern impoundment area. Surface of the stockpile will be covered with a foam capable of suppressing the dust during the storage period. The southern impoundment excavation area is raised using four feet of borrow and prepared using a double liner meeting the RCRA landfill requirements. Details for a typical RCRA-type liner are shown in Figure 4-5. The layers of the liner from bottom to top include a 2-foot-thick layer of clay, a layer of 60-mil high density polyethylene (HDPE) synthetic membrane, a layer of drainage net for secondary leak detection, another layer of 60-mil HDPE, 1-foot-thick layer of sand for the collection of leachates, 4-inch PVC pipe in the sand layer, and a layer of filter fabric. This construction places the liner top five feet above the water table. A six-inch-thick subgrade is prepared to provide a base for the clay liner. All large site stones and protrusions will be covered with regraded soils. After installation of the double liner, the temporarily stockpiled southern impoundment material will be transferred back to the southern impoundment area.

The second stage of consolidation effort involves excavation of waste materials at the northern impoundment and earthen berm divider (2,190 cubic yards), temporarily stockpiling of this material at the southern impoundment area, and construction of the northern impoundment double-liner system. Suppressant foam will be used to cover the stockpile for dust prevention as well as to prevent surface erosion from rain. The southern liner system will be expanded to the northern impoundment. Once the northern impoundment is lined, the material stockpiled in the southern impoundment will be properly distributed over the entire (northern and southern) impoundment area. The entire impoundment will be capped using a RCRA-type cap.

The RCRA-type cap includes a 2-foot-thick layer of clay, a layer of 60-mil HDPE synthetic membrane, a layer of drainage net, a layer of filter fabric, 18 inches of soil, 6 inches of topsoil, and vegetation. A six-inch-thick subgrade is prepared to provide a base for the clay liner. All large size stones and protrusions will be covered with regraded soils.

The primary barrier to downward infiltration caused by precipitation is provided by the clay. The clay barrier layer is placed and compacted in six-inch maximum lifts and has a design permeability of 1×10^{-7} cm/s or less. The second barrier to infiltration is a 60-mil HDPE liner. A drainage/filter layer is then placed on top of the liner. This layer is comprised of a synthetic drainage net (hydronet) and a layer of filter fabric. The drainage net intercepts and channels infiltration to drainage trenches around the cap (Figure 4-4) and the filter fabric aids in preventing fine particles from entering and clogging the drainage layer. The final layer of the cap consists of a minimum two-foot thickness of soil. The top six-inch layer is capable of supporting vegetation and protects the underlying cover components from movement due to winds and from ultraviolet degradation. The capping soils will be obtained from off-site borrow areas. The topsoil is fertilized and seeded.

The surface of the cap is graded with a minimum of 2 percent slope toward each side to reduce the amount of standing water on the cap. Drainage ditches around the cap will carry this runoff to catch basins as shown in Figure 4-1. Since the storm water does not come in contact with any waste, it will be tied to the site's storm water system and discharged to the river. The cap covers an area slightly beyond the edge of the swamp and covers the impoundments and sludge pit.

An annual inspection will be performed to determine if there has been any noticeable damage to the cap and, if so, the cap will be repaired. Planned maintenance will consist of fertilizing and mowing the grass and other activities, as required.

4.2.2 Incinerate Hot Swamp Materials

The hot swamp materials (approximately 50 cubic yards containing greater than 500 mg/kg of PCBs) is excavated, drummed, and transported to the SCA/Chem-Waste incineration facility in Chicago, Illinois or any other similar facility licensed for incineration of PCBs. The incineration technique is the most feasible alternative for detoxification of PCB wastes and volume reduction of wastes. This will minimize the environmental risks associated with PCBs.

4.2.3 Slurry Wall/Cap Swamp

Remaining swamp materials (3,250 cubic yards) contain low and moderate materials (containing less than 500 mg/kg PCB) within the trace amount of F019 wastes. In order to minimize the ground water contact with these remaining wastes, a slurry wall and cap will be used. If this alternative is selected for implementation, the ground water table will be maintained seven feet below the swamp's ground surface (five feet below the remaining wastes) by pumping. Details for the extraction well for this purpose should be provided during the construction design phases.

The remaining swamp materials are contained by constructing an approximately 25-foot-deep slurry wall around the entire parameter. Due to the presence of only trace amounts of silts and a bedrock elevation greater than 250 feet beneath the site, a hanging slurry wall is constructed. The slurry coupled with the ground water extraction wells inside the slurry wall will maintain separation with the swamp waste and the ground water. In addition, the area will be covered with a RCRA-type cap to prevent further infiltration of precipitation into the waste and to limit the potential for human exposure to site constituents via direct contact.

The slurry wall is constructed by excavating a narrow trench (usually two to three feet wide) through the pervious layers and keyed into the silt clay layer. The trench is excavated with the use of a backhoe. The sides of the trench are maintained from collapsing by keeping the trench filled with the bentonite slurry during excavation and prior to backfilling. To ensure full contact at the bottom of the excavation with the silty clay, the base of the excavation is probed for unconsolidated material, cracks, and potholes using an airlift. Pervious material in natural depressions and sand or sediment that settles out of the slurry are removed by an airlift pump. When the sand-slurry mix is blown out of the airlift pump and onto the bank, the sand settles out and the slurry is drained back into the trench. After the trench has been excavated under a bentonite slurry, a mixture of soil and bentonite is placed in the trench, displacing the bentonite slurry. This backfill material is designed to have a permeability of 10^{-7} cm/s and to be resistant to attack and degradation by the site materials being contained. Assuming the excavated materials provide a suitable backfill, slurry is mixed with the soil on a concrete pad. Additional borrow may be necessary for the backfill mix if existing site materials do not provide sufficient fine-grained materials. A bulldozer is used to work the material to a smooth consistency. The backfill is then pushed into the trench so that the backfill slope displaces the bentonite slurry forward. The excavation and backfilling activities are phased to make the operation continuous with relatively small quantities of new slurry required to keep the trench full.

The slurry wall is monitored to evaluate the continuing effectiveness of the wall in the subsurface environment. Potential geotechnical problems that require consideration after a slurry wall has been installed relate to basal stability, ground movement behind the wall, ground water level and chemistry, and surface water chemistry. The selection of the specific monitoring program is dependent upon questions remaining after completion of the detail design and problems encountered either during or after the construction phase.

4.2.4 Flood Berm

Most of the area of the site including the impoundment and swamp areas are within the 100-year floodplain. The elevation of the 100-year floodplain at this site is 827 feet mean sea level (MSL).

A berm (approximately 10 feet high and 700 feet long) will be installed along the Tuscarawas River for flood prevention at this site. The berm extends between the two high points located west and south of the site property boundaries. This will prevent a 100-year flood from reaching the waste materials which will remain on site.

4.2.5 Treat/Monitor Ground Water

Contaminant concentrations leaving the site will be monitored to assure that these concentrations do not exceed acceptable limits. Upgradient and downgradient monitoring wells will be used for this monitoring.

4.2.6 Restrictions

Restriction measures including fence, restriction signs, and deed restrictions will be used, as described for Alternative 1.

4.3 ALTERNATIVE 3 - OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP~~, AND MONITOR GROUND WATER~~

This alternative is a combination of treatment and source control/management. This alternative satisfies the remedial action goals by eliminating the contamination sources at the site and reducing exposure to PCB-contaminated soils by incineration. Additionally, it will eliminate the potential risks to human health and the environment at the site. The major components of this alternative include the following:

- Off-site treatment/disposal of impoundment materials
- Incineration of hot swamp materials
- Off-site treatment/disposal of remaining F019 sludge in swamp
- ~~Monitoring ground water~~
- ~~Restrictions~~

A plan view of this alternative and typical cross sections are shown in Figures 4-6 and 4-7, respectively.

4.3.1 Off-Site Treatment/Disposal Impoundment

All the F019 wastes in the southern and northern impoundments and sludge pit (5,570 cubic yards) will be excavated to cleanup levels and hauled to a permitted landfill facility or a reclamation/reuse facility, as required. This will eliminate the source for potential ground water contamination at the impoundment area. Adequate treatment will be accomplished by stabilization/solidification of the heavy metals and by an oxidation process for destruction of cyanides within the waste material. Due to the limited quantity of wastes, on-site treatment of the excavated materials prior to off-site transportation is not warranted; therefore, the waste material will be treated at the disposal facility before landfilling. The excavated materials will be dewatered, if required. The dewatering process may consist of simply placing the wastes on an engineered pad or use of a mechanical (vacuum, filter press, or belt press) dewatering system.

Excavation is performed using conventional equipment. A hydraulic excavator removes waste and a front-end loader removes waste from the excavation to keep the work area clear. The excavated areas of the impoundment will be backfilled with clean borrow (approximately 5,600 cubic yards).

4.3.2 Incineration of Hot Swamp Materials

Hot swamp materials (50 cubic yards) will be excavated, drummed, transported, and incinerated at an approved incineration facility.

4.3.3 Off-Site Treatment/Disposal of Remaining F019 Sludge in Swamp

Remaining F019 sludge in swamp (3,250 cubic yards) will be excavated to cleanup levels and hauled to an approved permitted landfill. The excavated area will require no further backfilling since the average depth of the sludge within the swamp is approximately 1.7 feet. The swamp area will be graded, as required, and seeded to promote the revegetation of this area. These materials will be treated before landfilling. Because of possible instability of the swamp, roadways should be installed and used in the swamp excavation.

4.3.4 Monitoring ~~of Ground~~ Water

Monitoring of ~~ground~~ water is perform~~ed similar~~ to Alternative 2.

4.4 ALTERNATIVE 4 - OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT, INCINERATE F019 SLUDGE IN SWAMP~~, AND MONITOR GROUND WATER~~

This alternative is a combination of treatment and source control/management. It is similar to Alternative 3, except the remaining F019 sludge in the swamp will also be incinerated rather than treat/disposal. The major components of this alternative include the following:

- Off-site treatment/disposal of impoundment materials
- Incinerate F019 sludge in swamp
- ~~Monitoring ground water~~
- ~~Restrictions~~

A plan view of this alternative and typical cross sections are shown in Figures 4-8 and 4-9, respectively.

4.4.1 Off-Site Treatment and Disposal of Impoundment Materials

All F019 sludges (5,570 cubic yards) at the impoundment including the sludge pit will be excavated to the cleanup levels for the F019 wastes. Similar to Alternative 3, these sludges will be transported to an approved permitted landfill or a reclamation/reuse facility, as required. Additionally, the excavated area at the impoundment will be backfilled with clean borrow.

4.4.2 Incinerate F019 Sludge in Swamp

All F019 sludge in the swamp (3,300 cubic yards) will be excavated, properly containerized, and transported off site to an approved incineration facility. The total excavation at the swamp is estimated to be approximately two feet. Therefore, the excavated area will be left as it is, with no further backfilling since the average depth of the sludge within the swamp is approximately 1.7 feet. The swamp area will be graded, as required, and seeded to promote the revegetation of this area. Removal of these materials will eliminate the major contamination source of PCBs at this site, while incineration contributes to the total destruction of PCBs and the minimization of associated environmental risks.

4.4.3 Monitoring ~~Ground Water~~

Monitoring of ~~ground water will be performed similar~~ to Alternative 2.

4.5 ALTERNATIVE 5 - ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER

This alternative is a combination of treatment and source/management. This alternative is similar to Alternative 3, except on-site landfill will be used for disposal of impoundment materials rather than using off-site disposal. The major components of this alternative include the following:

- On-site treatment/landfill impoundment
- Incinerate hot swamp materials
- Off-site treatment/disposal of remaining F019 sludge in swamp
- Monitoring ground water
- Restrictions

A plan view of this alternative and typical cross sections are shown in Figures 4-10 and 4-11, respectively. Details on each component are described below.

4.5.1 <u>On-Site Treatment/Landfill Impoundment</u> [illegible]

The impoundment materials (5,570 cubic yards) will be excavated and placed at an on-site landfill to be constructed at the general location of the sludge pit. The landfill will be constructed meeting the RCRA standards for disposal of hazardous waste. In addition, the bottom of the landfill will be constructed above the 100-year floodplain elevation (827 ~~830~~ feet MSL). ~~This meets state ARARs~~ for compliance with ~~100-year flood prevention~~. The cross section for the on-site landfill is shown in Figure 4-12.

The construction of the on-site landfill (~~RCRA-type vault)~~ will be performed in nine steps. Step 1 includes excavation of the northern impoundment including earthen berm divider material (2,190 cubic yards) and temporary storage of excavated materials at the southern impoundment area. Step 2 includes backfilling the excavated area and construction of the treatment pad. Step 3 includes excavation of the sludge pit (1,500 cubic yards), temporary storage at the treatment pad, and backfilling the excavation area. Step 4 includes the addition of approximately 10 feet of fill and compaction for preparation of the landfill area (approximately one acre) and raising the elevation to ~~830~~ feet MSL (100-year floodplain). Step 5 includes the construction of the landfill. Step 6 includes the treatment of the wastes stored at the treatment pad and placement at the landfill ~~(RCRA-type vault)~~. Step 7 includes the treatment of the wastes stored at the southern impoundment area and placement at the landfill. Step 8 includes excavation of the wastes at the southern impoundment, treatment, and placement at the landfill. Finally, Step 9 includes capping of the landfill, backfilling the southern impoundment, and revegetation of the landfill and the site area.

The impoundment material will be treated for metals and cyanides to levels which will meet the F019-type waste pretreatment (treatment) requirements for disposal. The treatment system will be installed at the treatment pad adjacent to the landfill ~~(RCRA-type vault)~~. The treatment pad will include a six-inch concrete pad which will serve as the temporary storage area before the waste treatment. The waste materials will be mixed with a solution of sodium hypochlorite for oxidation/destruction of cyanides. Mixing will be performed in a rotary mixing tank(s) similar to a cement mixing truck. After the completion of oxidation treatment in the mixing tank, the waste material will be mixed with adequate quantities of stabilizing/solidifying agents required for the lime-based solidification technique. Solidification results in the production of monolithic block binding. Therefore, significant heavy metal reduction in solubility, mobility, and structure permeability will be achieved. The quantitative and qualitative specifications for oxidation and stabilization will be defined during a treatability study program required prior to implementation of this alternative. The treated materials will then be placed inside the RCRA landfill. The exposed surface of materials is covered with foam for suppressing dust during this storage period until capping of the landfill is initiated. All excavated areas within the impoundment areas will be backfilled with clean borrow and revegetated.

The RCRA landfill will contain primary clay plus a synthetic membrane composite liner and a secondary synthetic membrane liner. In addition, it will be constructed with a leak detection system and leachate collection system. The landfill will be capped using a RCRA-type multilayer capping system. The cap will include a clay liner, synthetic liner, flow zone (drainage net and geotextile fabric), 18 inches of soil, 6 inches of topsoil, and vegetation. Figure 4-4 shows a typical cross section for a RCRA type liner.

The landfill will be approximately one acre and approximately 20 feet high (top elevation of 850 feet MSL). This includes a 150 percent volume increase due to the addition of the stabilizing agents during the treatment process before landfilling.

Controlling design parameters used to design the on-site treatment/vault are: (1) volume of waste, (2) volume of additives (especially solidifying agents, and (3) RCRA requirements for landfills.

4.5.2 Incineration of Hot Swamp Material

Similar to Alternative 3, the hot swamp materials (50 cubic yards) are excavated, containerized, transported, and incinerated at a permitted incineration facility. Incineration will contribute to both waste reduction and waste detoxification.

4.5.3 Off-Site Treatment/Disposal of Remaining F019 Sludge in Swamp

Similar to Alternative 3, the remaining F019 sludge in swamp (3,250 cubic yards) will be excavated, containerized, and transported to an approved permitted landfill. These materials will be treated before landfilling at the disposal facility.

4.5.4 Monitoring of the Ground Water

Monitoring of the ground water will be done similar to Alternative ~~3~~ 2.

4.5.5 Restrictions

Restriction measures including fence, restriction signs, and deed restrictions will be used as described for Alternative 1.

4.6 ALTERNATIVE 6 - ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE SWAMP MATERIALS, AND MONITOR GROUND WATER

This alternative is a combination of treatment and source control/management. This alternative is similar to Alternative 5, except all the swamp materials are incinerated. This alternative satisfies the remedial action goals by containing the contamination sources at the site and by detoxification of the PCB-contaminated swamp materials using incineration. The major components of this alternative include the following:

- On-site treatment/landfill impoundment
- Incineration of swamp materials
- Monitoring of the ground water
- Restrictions

A plan view of this alternative and typical cross sections are shown in Figures 4-13 and 4-14, respectively. Details for each component are described below.

4.6.1 On-Site Treatment/Landfill Impoundment

Similar to Alternative 5, the impoundment materials (5,570 cubic yards) will be excavated, treated, and placed in an on-site landfill (~~RCRA-type vault)~~. Details for on-site treatment/landfilling are provided in Alternative 5.

4.6.2 Incineration of Swamp Materials

Similar to Alternative 4, all the swamp materials (3,300 cubic yards) will be excavated, containerized, transported, and incinerated at an approved, permitted incineration facility. Incineration provides the best technique for destruction of PCBs; therefore, it minimizes the associated environmental risks.

4.6.3 Monitoring of the Ground Water

Monitoring of the ground water will be performed as described for Alternative 2.

4.6.4 Restrictions

Restriction measures including fence, restriction signs, and deed restrictions will be used as described for Alternative 1.

4.7 ALTERNATIVE 9 - ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, ON-SITE TREATMENT/LANDFILL REMAINING F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER

This alternative is the same as Alternative 5 (a combination of treatment and source control/management), except for the remediation of the swamp materials. The swamp F019 sludges after removal of hot materials will be treated and disposed of on site. The major components of this alternative include the following:

- On-site treatment/landfill impoundment
- Incineration of hot swamp materials
- On-site treatment/landfill of remaining F019 sludge in swamp
- Monitoring of the ground water
- Restrictions

A plan view of this alternative and typical cross sections are shown in Figures 4-15 and 4-16, respectively.

4.7.1 On-Site Treatment/Landfill Impoundment

Similar to Alternative 5, impoundment materials (5,570 cubic yards) will be excavated, treated, and placed in an on-site landfill (~~RCRA~~-type vault). Details on construction of the landfill are provided in Alternative 5. Same as Alternative 5, the landfill will meet RCRA and ~~ARARs~~ requirements, except this landfill also will be used for disposal of remaining F019 sludge in swamp (3,250 cubic yards). Since the swamp F019 sludge may contain low and moderate materials (materials with less than 500 mg/kg PCB), therefore, the landfill will be designed in a way to segregate the swamp sludges from the impoundment materials. The landfill will be constructed at an elevation above the 100-year floodplain and installed at the sludge pit general area. The cross section of the landfill is shown in Figure 4-17. All other treatment techniques constructional details and steps for the landfill will be the same as Alternative 5.

4.7.2 Incinerate Hot Swamp Material

Similar to Alternative 3, the hot swamp materials (50 cubic yards) will be excavated, containerized, transferred, and incinerated at an approved, permitted incineration facility.

4.7.3 On-Site Treatment/Landfill Remaining F019 Sludge in Swamp

As described before, the remaining F019 sludge in the swamp (3,250 cubic yards) will be excavated, treated, and placed in the above on-site landfill (RCRA~~-type vault).~~ Special construction of the landfill will provide segregation of the PCB-contaminated swamp sludges and the impoundment materials. The landfill will be approximately one acre in area and 20 feet in height. This landfill is approximately 70 percent greater in height than the landfill in Alternative 5 to accommodate the 60 percent increase in waste materials.

4.7.4 Monitoring of the Ground Water

Monitoring of the ground water will be performed the same as Alternative 2.

4.7.5 Restrictions

Restriction measures including fence, restriction signs, and deed restrictions will be used as described for Alternative 1.

5.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

The detailed evaluations of alternatives are the analyses and presentation of relevant information necessary to select a site remedy. Each alternative passing the initial screening (i.e., Alternatives 1, 2, 3, 4, 5, 6, and 9) will be assessed in a fashion that demonstrates and documents the capacity of each alternative to satisfy the statutory requirements that must be addressed in the Record of Decision (ROD). These include the requirements of the CERCLA and SARA to:

- Protect human health and the environment
- Attain applicable or relevant and appropriate requirements (ARARs) or support for a waiver
- Be cost-effective
- Provide permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable
- Preferentially select treatment that reduces toxicity, mobility, or volume as a principal element

Additional statutory considerations relative to the recent emphasis on evaluating long-term effectiveness and related considerations for each of the alternative remedial action includes the following:

- Long-term uncertainties associated with land disposal
- Requirements of the Solid Waste Disposal Act
- Persistence, toxicity, and mobility of hazardous substances and constituents, and their propensity to bioaccumulate
- Short- and long-term potential for adverse health effects for human exposure
- Long-term maintenance costs
- Potential for future remedial action costs if the alternative remedial action implemented were to fail

Nine evaluation criteria have been developed to address the CERCLA requirements and considerations listed above as well as additional technical and policy considerations that have proven to be important for selection among remedial alternatives. The evaluation criteria are:

- Short-term effectiveness
- Long-term effectiveness
- Reduction of toxicity, mobility, or volume
- Implementability
- Cost
- Compliance with ARARs
- Overall protection of human health and the environment
- State acceptance
- Community acceptance

5.1 OVERVIEW OF EVALUATION CRITERIA

The nine evaluation criteria encompass technical, cost, and institutional considerations; compliance with specific statutory requirements; and state and community acceptance. Descriptions of each criterion are presented in the following sections.

5.1.1 SHORT-TERM EFFECTIVENESS

The assessment against this criterion considers the effectiveness of each alternative in protecting human health and the environment during the construction and implementation period until the response objectives have been achieved. The following factors will be addressed under this criterion:

- Protection of the Community During Remedial Actions - Addresses risks that result from implementation of the proposed remedial action (such as dust from excavation) that may affect human health

- Protection of Workers During Remedial Actions - Assesses risks that may be posed to workers and the effectiveness and reliability of protective measures that could be taken

- Environmental Impacts - Addresses the potential adverse environmental impacts that may result from implementation of an alternative and evaluates how effective available mitigation measures would be in preventing or reducing the impacts

- Time Until Remedial Response Objectives are Achieved - Includes an estimate of the time required to achieve protection for either the entire site or individual elements associated with specific site areas or threats

5.1.2 Long-Term Effectiveness and Permanence

The assessment of alternatives against this criterion evaluates the long-term effectiveness of each alternative in protecting human health and the environment after response objectives have been achieved. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes. The following components will be addressed under this criterion:

- Magnitude of Remaining Risk - Assesses the residual risk remaining from untreated waste or treatment residuals after the achievement of the remedial response objectives
- Adequacy of Controls - Assesses the adequacy and suitability of controls, if any, that are used to manage treatment residuals or untreated wastes that remain at the site
- Reliability of Controls - Assesses the long-term reliability of management controls for providing continued protection from residuals

5.1.3 Reduction of Toxicity, Mobility, or Volume

The assessment against this criterion evaluates the anticipated performance of specific treatment technologies. This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies to permanently and significantly reduce toxicity, mobility, or volume of wastes.

This evaluation criterion focuses on the following factors:

- Treatment processes, remedies they will employ, and materials they will treat
- The amount of hazardous materials that will be destroyed or treated, including how principal threats will be addressed
- The degree of expected reduction in toxicity, mobility, or volume measured as a percentage of reduction
- The degree to which the treatment will be irreversible
- The type and quantity of treatment residuals that will remain following treatment

5.1.4 Implementability

The implementability criterion addresses the technical and administrative feasibility of implementing each alternative and the availability of various services and materials required during implementation. This criterion involves analysis of the following factors:

- Technical Feasibility:
  - Construction and Operation - Relates to the technical difficulties and uncertainties associated with a technology. This analysis will address the alternative as a whole.
  - Reliability of Technology - Focuses on the ability of a technology to meet specified process efficiencies or performance goal and on the probability that technical problems will result in nonperformance and schedule delays.
  - Ease of Undertaking Additional Remedial Action - Discusses types, if any, of future remedial actions which may need to be undertaken and how difficult it would be to implement such additional actions.
  - Monitoring Considerations - Addresses the ability to monitor the effectiveness of each alternative and includes an evaluation of the risks of exposure that exist if monitoring is inadequate to detect a system failure.
- Administrative Feasibility:
  - Activities needed to coordinate with other offices and agencies (e.g., obtaining permits for off-site activities or rights of way for construction).
- Availability of Services and Materials:
  - Availability of adequate off-site treatment, storage capacity, and disposal services
  - Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources
  - Timing of the availability of technologies under consideration
  - Availability of services and materials, plus the potential for obtaining competitive bids.

5.1.5 Cost

Cost evaluation of each alternative includes consideration of capital costs and annual costs. The accuracy provided by these cost estimates ranges from plus 50 percent to minus 30 percent. A present worth analysis is also conducted, allowing all remedial action alternatives to be compared on the basis of a single figure. These three components are discussed in the following paragraphs:

- Capital Costs - Capital costs consist of direct (construction) and indirect (nonconstruction and overhead) costs. Direct costs include expenditures for the equipment, labor, and materials necessary to install remedial actions. Indirect costs include expenditures for engineering, financial, and other services that are not part of actual installation activities but are required to complete the installation of remedial alternatives.

- Annual Costs - Annual costs are postconstruction costs necessary to ensure the continued effectiveness of a remedial action. Costs that must be incurred in the future as part of the remedial action alternative, such as incineration cost, will be identified and noted as progressive operating costs for the year in which they occur.

- Present Worth Analysis - An economic analysis considering the time value of money is conducted after completion of the cost estimate to allow comparison of alternatives. The comparison is made by using a present worth analysis. Expenditures that occur over different time periods are evaluated by discounting future costs to the current year. This single figure represents the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount factor of 10 percent, a 5 percent inflation factor, and a 30-year period of performance is used in the analysis. An exception is made for the off-site disposal of ash. Considering the landfill statute restrictions and stringent permit requirements, landfill rates are expected to rise at a faster rate than other industrial norms. Therefore, a 10 percent inflation factor is used for off-site disposal.

5.1.6 COMPLIANCE WITH ARARs

This evaluation criterion is used to determine how each alternative complies with ARARs. ARARs can be categorized into three broad classifications, as follow:

- Containment Specific - These ARARs define acceptable exposure levels for specific chemicals and are used in establishing remedial action objectives.

- Action Specific - These typically set controls or restrictions for particular treatment or disposal activities.

- Location Specific - These typically set restrictions with specific locations such as wetlands, flood plains, historic sites, etc.

The detailed analysis summarizes which requirements are applicable or relevant and appropriate to an alternative and the ability of the alternative to fulfill these requirements. In addition, the alternatives are also assessed against other information in the form of advisories, criteria, and guidances that are not ARARs but have been identified by the agencies as criteria to be considered (TBC) because they have been determined to be necessary to ensure protection of human health and the environment and are appropriate for the site. The Alsco-Anaconda NPL site ARARs and TBCs are presented in Appendix B, as developed by the state and federal agencies.

5.1.7 Overall Protection of Human Health and the Environment

The assessment against this criterion describes how the alternative, as a whole, protects and maintains protection of human health and the environment. The overall assessment of protection is based on a combination of factors previously assessed under other criteria, including long-term effectiveness, short-term effectiveness, and compliance with ARARs.

This evaluation focuses on how a specific alternative achieves protection over time and how site risks are reduced. The evaluation will also indicate how each source of contamination is to be eliminated, reduced, or controlled for each alternative.

5.1.8 State Acceptance

This assessment evaluates the technical and administrative issues and concerns the state (or support agency in the case of state-lead sites) may have regarding each of the alternatives.

The analysis will be limited to formal comments made during previous phases of the RI/FS and will describe the process used by the lead agency to obtain input from the support agency during preparation of the RI/FS.

5.1.9 Community Acceptance

This assessment incorporates public input into the analysis of alternatives and reflects the community's apparent preferences or concerns about alternatives. There is no formal opportunity for public comment during the preparation of the RI/FS; however, formal public comments are provided during the 30-day public comment period on the RI/FS report and proposed plan. Public concerns or comments will be addressed in the Record of Decision (ROD) and responsiveness summary. Where community positions on specific alternatives have been documented during preparation of the RI/FS, the detailed analysis will address those features the community supports, has reservations about, or opposes.

5.2 PRESENTATION OF INDIVIDUAL ALTERNATIVE ANALYSIS

The following sections present the analysis of each alternative against the nine criteria discussed in Chapter 3.0. ~~The proposed ground water extraction and treatment technology is identical in all alternatives.~~

5.2.1 Analysis of Alternative 1

Short-Term Effectiveness

Under no-action alternative, no remediation is proposed; however, items included are construction of a security fence (8 feet high and approximately 1,000 feet long) to control public trespass, deed restrictions (use restriction to control future use of site)~~, and ground water monitoring.~~

Contaminants detected on the site in the F019 sludge that may pose human health problems include arsenic, cadmium, chromium, cyanides, and PCBs. Potential receptors identified around the site include 1,320 residents of Gnadenhutten community. As indicated by the mayor of Gnadenhutten, a high percentage of inhabitants are over the age of 55 years, and a large number work for Alsco; therefore, the potential for Alsco employees to be exposed to the waste is greater than the general public.

Dermal contact or oral ingestion are the major routes of exposure for Alsco employees; however, the proposed security fence around the waste area will eliminate the potential for casual employee or public exposure to contaminated waste. Employees with reason to enter the fenced area will be aware of the contaminants present.

The inhalation pathway is not a viable route of employee exposure due to the highly liquid nature of the waste and that the sludge will remain undisturbed in the no-action alternative. High water content (preventing dust or dry conditions) in sludge and vegetation overgrowth in and around the waste disposal areas will reduce the air emissions.

Surface and ground water are the principle modes of contaminant transport from the Alsco site. Metals and PCBs present in the waste under this alternative have the potential to leach and migrate toward the ground water and/or the Tuscarawas River.

Dilution calculations have shown that, under low-flow conditions in the Tuscarawas River, the contribution of contaminants from ground water will not have a significant impact on public health and the environment. There are no identified human health risks for metals (except arsenic), cyanide, or organics (except PCBs) at the site.

The Tuscarawas River water quality data are generally in compliance with the regulatory guidelines, except for chloride, iron, and manganese around the Gnadenhutten site. U.S. EPA's VHS Model calculation shows that the postulated drinking water intake point 50 meters from the leaching sludge does not exceed U.S. EPA's Safe Drinking Water Act (SDWA) standards or U.S. EPA Water Quality Criteria (WQC).

Excess cancer risks due to arsenic and PCBs exist on site for the direct contact scenario; however, a proposed security fence will eliminate direct contact of human receptors with the waste material.

Long-Term Effectiveness and Permanence

Under this alternative, no direct engineering controls are provided to prevent exposure to sludges and contaminated soils. There is a 100 percent probability of the continuation of contaminants leaching from the site and reaching to the Tuscarawas River and ground water.

The Tuscarawas River is not used as a drinking water source by the town of Gnadenhutten. The river is largely used for recreation. WQC data indicate that there is no identified potential for exposure to contaminants due to boating, fishing, and swimming.

Since the PCB source is Aroclors 1248 and 1254, the site will continue to be a threat if remediation is not accomplished. In addition, the toxicity over time will not decrease for the PCB contaminated waste materials.

Reduction of Toxicity, Mobility, or Volume

For the purposes of this evaluation, reduction in toxicity is defined as an alteration of chemical structure to render the constituent less harmful to human health. Likewise, a reduction in mobility would be achieved by chemical fixation or solidification. Finally, treatment technologies such as incineration are considered to represent methods that would reduce the total waste volume requiring disposal.

No reduction in toxicity, mobility, or volume will occur since no treatment is employed in the no-action alternative.

Implementability

No major construction is proposed for this alternative, therefore, no technical difficulties will be experienced and permitting will not be required. The approximate time frame to complete this alternative is three months.

Cost

Capital and annual costs were estimated for Alternative 1. A present worth analysis was also conducted. These costs are discussed below and are summarized in Table A1 of Appendix A.

Capital Cost

Capital costs for this alternative include direct capital costs for the equipment, labor, ~~and materials necessary to install the compliance wells for the monitoring of ground water~~ and the fence to secure the NPL site. Indirect capital costs for engineering and contingencies are also included. The total capital investment for this alternative is ~~$91,000.~~

Annual Costs

~~Annual costs for this alternative are expected to include costs for monitoring and statistical analysis.~~ Costs are also included every five years for a reevaluation of this alternative, as required by SARA. Total annual costs are estimated to be ~~$67,000~~ per year.

Present Worth

A present worth analysis was calculated using a 5 percent inflation rate and a 10 percent discount factor over a 30-year period. The present worth value of this alternative is ~~$1,135,718.~~

Compliance With ARARs

Alternative 1 no action would not meet any of the ARARs and TBCs determined applicable for the Alsco-Anaconda NPL Site.

Overall Protection of Human Health and the Environment

Based on the remedial investigation and risk assessment results (IT, 1989), the contribution of ground water constituents to the river will not have a significant impact on the public health or environment.

However, excess cancer risk is calculated to exist for those subpopulations that come into direct contact, via trespass, with Areas 1, 2, 3, 4, and 5 PCB sludges at the site. Therefore, the no-action alternative does not provide overall protection of human health and the environment.

State Acceptance

The state generally prefers that the waste materials did not remain within the 100-year floodplain. Since there are other feasible alternatives for this NPL site, the no-action alternative should not be considered.

Community Acceptance

Public concerns and comments will be addressed in the responsiveness summary and ROD.

5.2.2 Alternative 2 - Consolidate/Cap Impoundment, Incinerate Hot Swamp Materials, Slurry Wall/Cap Swamp, Flood Berm, and Monitor Ground Water

Short-Term Effectiveness

No detrimental effects will be posed on the community during excavation and consolidation of sludges from the northern impoundment; however, there is a potential for environmental release of organic vapors and PCBs during excavation from the southern impoundment sludge and hot swamp material containing greater than 500 mg/kg PCBs.

Removal of above 500 mg/kg PCB material from the site will immediately eliminate the major source of potential carcinogens from site. This will reduce leaching of PCBs into ground water and the Tuscarawas River.

Other construction activities such as installation of a RCRA-type liner and cap and slurry wall construction will not pose any environmental concerns and will have immediate beneficial effect on off-site migration of contaminants.

Construction of the berm along the downstream of the swamp area may release airborne particulates containing metals and a low concentration of PCBs, thus posing a potential for inhalation exposure to the public and Alsco employees.

Proposed spraying of stockpiles with foam or dust suppressant will reduce the environmental release of airborne particulates. As indicated in the liner design, clay will be used at the bottom of the impoundment. Trucking of the clay borrow materials has the potential for release of noncontaminated particulates in the air.

During the construction of the slurry wall and capping of the swamp area, there is potential for dermal contact and/or inhalation exposure of PCBs to construction workers. However, these workers will be adequately protected by clothing and respiratory protection. Leaving less than 500 mg/kg of PCB-containing sludge may be detrimental to the environment if the slurry wall/cap fails. There is also the potential of human exposure to PCBs if the site security system fails.

The installation of the slurry wall will stop short-term incremental contamination of ground water and the Tuscarawas River. ~~Additionally, treatment and monitoring of ground water will immediately show improvement in water quality.~~

If proper respiratory and dermal protection for workers (i.e., protective clothing, etc.) are provided, unacceptable risks posed to workers during the implementation of this alternative are reduced to acceptable levels.

Long-Term Effectiveness

This alternative provides long-term protection to human health and environment.

Excavation and consolidation of sludge from the impoundment following emplacement in a RCRA-lined landfill and cap will eliminate the potential for contact with human receptors. This will also eliminate leaching and migration of contaminants from the sludge into ground water and the Tuscarawas River. The leachate collection and leak detection system will monitor the effectiveness of the RCRA landfill.

An RCRA-type liner and cap consisting of clay, synthetic liners, leachate collection, and monitoring system is a U.S. EPA-accepted land disposal technique. The containment technique will significantly reduce risk to human health and the environment.

Removal of hot swamp material containing greater than 500 mg/kg PCBs will reduce the potential carcinogenic risks to human receptors. Further, this will eliminate the possibility of leaching and migration of PCBs into ground water and the Tuscarawas River. Construction of a 25-foot-deep slurry wall with 1×10^{-7} cm/s permeability will stop the movement of contaminants in ground water and the Tuscarawas River. The slurry wall with ground water extraction wells inside the slurry wall will maintain separation between the swamp waste and ground water. In addition, an RCRA-type cap over the swamp area will prevent infiltration of precipitation into waste and limit the potential for leaching.

Soil-bentonite slurry walls have been demonstrated to be reliable in the control of ground water at other installations. The effectiveness of the slurry wall is monitored with monitoring wells. The potential for failure of the slurry wall is quite small if adequate design and proper construction measures are adhered to. Although unlikely, failure of the slurry wall would cause reentry of contaminants to the ground water. This does not pose an imminent threat since there are methods available to repair the wall. The methods include grouting of cracks, reexcavation and backfilling, or placement of a synthetic liner. In addition, the ground water is being pumped and treated. This will create a hydraulic barrier for off-site migration of ground water and the contaminants.

Routine maintenance of the cap leachate collection and monitoring should provide long-term reliability for the Alsco-Anaconda site.

The risk from the residual wastes remaining on site, should the containment system fail, will be small. The inward ground water gradient due to pumping keeps contaminants from migrating out through the wall.

Installation of the berm (10 feet high by 700 feet long) along the Tuscarawas River will prevent a 100-year flood from reaching the residual waste materials on site should a flood event occur. The berm will require routine maintenance to maintain the stability of the structure. The long-term reliability will be provided as long as the Tuscarawas River does not elevate higher than the 10-foot-high berm.

Excavation and removal of hot PCB sludge from the swamp area will leave residual PCB concentrations of 10 mg/kg in soil. This concentration is acceptable for the nonrestricted area by U.S. EPA according to TSCA (Federal Register, Vol. 53, October 19, 1988). The RCRA cap and the slurry wall will further reduce the migration potential of PCBs.

Reduction of Toxicity, Mobility, or Volume

This alternative employs the construction of a RCRA landfill for impoundment materials, thermal treatment for swamp sludges with levels above 500 milligrams per kilogram (mg/kg) of PCBs, a RCRA cap and slurry wall around the remaining swamp materials.

The construction of a RCRA landfill would reduce the potential of exposure to impoundment constituents, but would not result in the reduction of toxicity, mobility, or volume of impoundment wastes. Incineration of swamp sludges with levels greater than 500 mg/kg will result in both a reduction of toxicity and volume of waste. The excavated PCB waste volume will be reduced by approximately 15 percent after incineration. The construction of a slurry wall around the swamp perimeter and a RCRA-type cap will limit migration of constituents to ground water and the potential for human exposure via direct contact, but will not result in a reduction of toxicity, mobility, or volume. The construction of a berm will contain waste materials on site during a 100-year flood, reducing the potential for off-site migration, but will not reduce toxicity, mobility, or volume.

Ground water treatment utilizing chemical precipitation and oxidation/chlorination will reduce levels of heavy metals, fluoride, and cyanides in ground water to state ARARs. Treatment will result in a reduction of toxicity and mobility of ground water constituents.

Implementability

Alternative 2 was analyzed against the implementability criterion which addresses the technical and administrative feasibility of the alternative. Discussions of these criteria are provided in the following sections.

Technical feasibility of containment of the Alsco-Anaconda NPL site wastes, in place, will require several construction activities, including the following:

- Elevation of the waste materials within the northern and southern impoundments to eliminate the contact of the waste material with ground water
- A soil-bentonite slurry wall surrounding the swamp area
- A an RCRA multimedia cap covering the entire affected area, including addition of a compacted low permeability clay-soil layer, installation of a synthetic HDPE membrane, construction of a flow zone using synthetic materials, and the grading and vegetation of a soil layer
- Construction of a berm along the bank of the Tuscarawas River

Prior to construction and engineering, investigations to perform the design of the slurry backfill mixture will necessitate exploratory borings along the proposed trench alignment.

Slurry walls have been installed to retard the movement of ground water and leachate at numerous waste sites. These walls have been constructed at sites having widely divergent geologic, hydrologic, climatic, and demographic characteristics. Slurry cutoff walls are not impermeable and some leakage is expected; however, soil-bentonite walls are generally designed to meet a permeability of 10^{-7} cm/s or lower. Because they provide lower permeabilities than cement bentonite, soil-bentonite walls are the most common type of wall applied to waste site remediation.

The design and construction activities for slurry trenches are relatively simple as long as thorough site investigation results are available and design and construction firms involved are experienced with slurry trench construction techniques. Sound construction methods along with strict adherence to quality controls are important requirements in the installation of the slurry wall. Improper installation may lead to the development of "windows" within the wall (zones of high permeability), a condition which can significantly impact the total performance of the barrier system.

To verify and document that the soil-bentonite wall is constructed in accordance with the design and specifications, a field quality control program is developed and implemented. This program typically consists of testing the following items:

- Slurry preparation (viscosity and filtrate loss)
- Slurry in trench (density and sand content)
- Trench excavation (alignment and depth)
- Backfill in mixing area (slump, moisture content, and gradation)
- Backfill in trench (density, sounding along backfill surface, and permeability)
- Bentonite (manufacturing certification)
- Water (pH and specific conductivity)

In addition to the testing and documentation of the above items, the following observations are made:

- Level of slurry in trench (trench stability)
- Level of backfill in trench (proper placement and advancement of backfill)
- Cuttings from the trench bottom (proper keying and cleaning of trench bottom)

Based on IT's experience in designing and constructing slurry walls, a high-level of confidence is attained after the completion of the filter cake and short-term permeability testing program. The long-term permeability tests are then conducted to confirm the short-term results (which indicated that the slurry wall will not undergo chemical breakdown from the worst-case site leachate). At this point (short-term) in the testing/design program, sound conclusions can be drawn with respect to the effectiveness of a particular design soil-bentonite mixture. In the unlikely event that no slurry wall mixtures pass the long-term compatibility tests, a different engineering solution will have to be developed.

The long-term reliability of the slurry wall at the Alsco-Anaconda NPL site will rely on the final design and quality of construction. The design process allows for proper backfill mixture development and long-term permeability testing under worst-case conditions. In addition, the in situ permeability of the slurry wall may improve (reduce) due to the impervious filter cake formation along the sides of the trench during construction.

The potential of wall failure is quite small if adequate design and proper construction measures are adhered to. However, potential wall failure can be due to chemical contaminant, stress/strain forces causing structural failure, or improper design and/or construction methods. In most cases, wall failure is due to poor design and construction specifications or lack of supervision during installation. Many problems can be avoided entirely with the proper knowledge and the ability to use it.

A breach in a wall caused by chemical attack usually originates in one small area of the wall. The cause for deterioration can be due to one of two factors: (1) an area of weakness exists in the wall, such as the type produced by inadequate mixing of the backfill material during construction or (2) the contaminant concentration is greatest in one location, e.g., a floating solvent layer present in the ground water column. In either case, the bentonite becomes dehydrated in one portion of the wall which causes an increase in porosity. This can result in a piping failure and an eventual breach in the wall. In the case where the cause for the breach is the nature of the contaminant and the wall material has a permeability specified in the design requirements, there is little that can be done to permanently restore the wall. A slurry wall is probably not the proper solution for that particular problem and a revision of the engineered solution should be required.

On the other hand, if a breach is due to a hole in the wall and the hole can be located with some accuracy, two restorative possibilities exist: (1) a synthetic liner can be placed along one side of the wall and (2) the breached area can be reexcavated and rebackfilled. In the case of a soil-bentonite wall, the soil-bentonite mixture tends to slide into any reexcavation, requiring that a long section of trench be dug out and rebuilt (Ryan, 1977).

Wall failures related to physical stress/strain forces do not usually result in a breach. Instead, physical stresses can cause cracking, which then allows leachate seepage through the wall. This type of failure rarely occurs (Ryan, 1977). If it does, however, there are three restorative actions that can be taken: (1) grouting of the cracks, (2) the reexcavation and rebackfilling of the wall (if the wall material consists of cement-bentonite), or (3) placement of a synthetic liner.

The third type of failure is not a failure of the wall but failure to properly construct a wall. This is due to either inadequate excavation and keying into the aquiclude or poor backfill design and/or mixing. The most frequent results of not keying into the underlying aquiclude properly is the seepage of leachate under the wall. This can be remediated by reexcavation and rebackfilling, if the problem area can be located. Wall failure due to permeability higher than the design requirements is a problem that should never occur. Proper construction supervision and backfill design specifications will prevent this type of failure.

The installation of the RCRA cap should present no technical difficulties; however, strict QA/QC procedures should be followed in the field when placing each layer of the cap. The RCRA cap effectively reduces infiltration of rainwater, thus, reduces leachate generation, and limits the potential for human exposure to site constituents via direct contact. The expected design life and reliability of this cap, (synthetic liner supported by a low-permeability base) is estimated for a long period (approximately 50 to 100 years). However, proper maintenance of the cap is necessary.

This containment system (i.e., slurry wall and cap) is monitored to detect any unexpected migration of site contaminants. Monitoring of the slurry wall usually involves monitoring of ground water levels inside and outside of the wall to ensure that design head levels are not exceeded. Ground water quality monitoring can be used to determine the effectiveness of the entire remedial effort. In the unlikely event that the monitoring system fails to detect a failure in the containment system, the risk of exposure is small because contaminants that may pass through the wall into the ground water will be collected and treated (if required).

The time frame to complete Alternative 2 is as follows:

- Engineering Design - Approximately 12 months
- Remedial Action Activities - Approximately 6 to 9 months

Availability of Materials and Services

The necessary equipment, materials, and services for this alternative are commonly available. The installation of the slurry wall utilizes commonly available construction equipment and techniques. However, they should be installed by specialty contractors. Commonly available construction equipment techniques and material will be used for installation of the cap. Most of the soil materials for capping are readily available in most areas of the country and synthetic materials are widely manufactured and distributed. The equipment used for implementing this technology is mostly standard road construction equipment; however, some specialized testing and installation equipment must be supplied by the synthetic liner installer or soil testing company.

Administrative Feasibility

Access to other properties may be required to install monitoring wells and for sample collection at receptor(s).

Costs

Capital and annual operating costs were estimated for Alternative 2. A present worth analysis was also conducted. Capital and base annual operating costs for this alternative are summarized in Table A1 of Appendix A.

Capital Costs

Capital costs for Alternative 2 include direct capital costs for the equipment, labor, and materials necessary for removal and incineration of the F019 sludge contaminated with PCBs greater than 500 ppm and installation of the slurry wall, cap, flood berm, fence, and compliance wells, if required. Indirect capital costs for engineering and contingencies are also included. The total capital costs for this alternative are $1,637,000.

Annual Costs

Annual costs for this alternative are expected to include costs for monitoring and statistical analysis and maintenance and inspections. Costs are also included for a reevaluation of this alternative every five years, as required by SARA. Total annual costs are estimated to be $85,000 per year.

Present Worth

A present worth analysis was calculated using a 5 percent inflation rate and a 10 percent discount rate over a 30-year period. The present worth value of this alternative is $2,962,389.

Compliance With ARARs

Alternative 2 does not meet all of the ARARs and TBCs determined applicable for the Alsco-Anaconda NPL Site. The ARARs and TBCs pertaining to this alternative are summarized in Table 5-2 and Appendix B.

~~The major ARAR that this alternative~~ will ~~not meet is~~ (OAC3745-54-18) ~~because~~ waste materials ~~will be located within the~~ floodplain ~~and also within 200 feet of the Tuscarawas River.~~ In addition, this alternative ~~will not comply with~~ Ohio House Bill ~~No. 592~~ which does not allow ~~waste materials~~ to remain in an ~~area where a~~ useable aquifer ~~is~~ located.

As previously discussed in this report, ground water will be investigated as a separate operable unit; therefore, this alternative will not meet the MCLs or accummulative cancer risk of greater than 10^{-4} to 10^{-7}, which ever is more stringent.

Overall Protection of Human Health and the Environment

The high-level PCB sludges would be removed from the site and the impoundment and swamp materials remaining on site will be capped and contained. These actions would reduce the potential for dermal contact and significant constituent migration to ground water. The berm is expected to contain waste constituents on site in the event of a 100-year flood. Pumping ground water inside the swamp slurry wall and ensuring a separation between the waste and ground water will further minimize potential for waste migration to the ground water.

In summary, this alternative controls the off-site migration and thereby reduces the potential for human health and environmental impacts. The primary risk to human health is addressed by removal of high-level PCB sludges and containment of remaining swamp sludges, although the potential for future impacts from two on-site RCRA landfills exist. Any short-term impacts would be minimized by dust suppression measures. Additionally, ground water is treated to meet ~~state water quality standards~~ providing greater protection of human health and the environment.

State Acceptance

The state generally prefers that all the waste materials be removed from the 100-year floodplain rather than partial removal and containment of the remaining waste materials supplemented with a berm to control flood waters as described by this alternative.

Community Acceptance

Public concerns and comments will be addressed in the responsiveness summary and ROD.

5.2.3 Alternative 3 - Off-Site Treatment Disposal Impoundment, Incinerate Hot Swamp Materials, Off-Site Treatment/Disposal of Remaining F019 Sludge in Swamp~~, and Monitor Ground Water~~

Short-Term Effectiveness

This alternative, combining source control and management, will have immediate effect since the removal of the waste will eliminate the potential risks to human health and the environment at the site. This alternative satisfies the remedial goals by eliminating the contamination source at the site and reducing potential exposure to PCB-contaminated sludges by off-site incineration.

Excavation and transport of sludges from the northern impoundment will pose minimal environmental concern because there is low potential for organic vapor or dust release during excavation or transport. The sludge from the southern impoundment has potential to release low concentrations of organic vapors to the environment during excavation. Other treatment processes such as dewatering of sludge, destruction of cyanide by oxidation, stabilization, solidification, etc., will be done off site; therefore, there is no potential impact on the near-site environment or employee exposure due to this process(es).

Excavation and removal of impoundment sludge to F019 clean closure cleanup levels or to a health-based cleanup level and backfilling with clean borrow will immediately reduce the potential for leaching of the contaminants from the sludge into ground water and/or the Tuscarawas River. If this is not achievable, then RCRA closure and postclosure care monitoring will be conducted, as required.

Excavation and removal of hot swamp material for off-site incineration will reduce the potential for human contact with the carcinogenic material. During excavation and removal of swamp sludge, there is a potential for worker dermal contact or inhalation exposure to PCBs; however, this can be eliminated by implementation of proper health and safety procedures. Removal of additional material from the site to F019 (~~Federal Register 1989~~) cleanup levels will eliminate the source and potential for human health risks.

Other components such as ~~security measures, use and restrictions on future development of the site, and~~ surface and ground water management will significantly reduce the potential of residual contaminants posing an environmental problem.

Long-Term Effectiveness and Permanence

This alternative provides long-term protection to human health and the environment. Removal of F019 sludge from the site will eliminate the potential source of contamination. Since the waste will be removed from the site, no long-term engineering design and controls are necessary. Security controls and surface water management programs ~~(monitoring)~~ will eliminate the residual contamination. Elimination of the flood protection plan will have no effect since all the waste will be removed from site.

Reduction of Toxicity, Mobility, or Volume

Alternative 3 will result in the reduction of toxicity and mobility of impoundment F019 waste constituents by off-site stabilization/solidification of heavy metals and oxidation and destruction of cyanides prior to off-site disposal.

Excavation and incineration of the swamp materials with PCB levels greater than 500 mg/kg will result in a reduction of both waste toxicity and volume.

The remaining swamp material will be excavated to F019 cleanup levels and treated, similar to impoundment wastes, prior to off-site landfill disposal. This procedure will reduce the toxicity and mobility of the swamp waste constituents prior to disposal. Additionally, source removal will preclude waste migration due to flooding.

Implementability

Implementation of Alternative 3 will require several construction activities including:

- Removal and off-site disposal of the impoundment F019 sludge material
- Removal and off-site incineration of the swamp F019 sludge material contaminated by PCBs greater than 500 ppm
- Removal and off-site disposal of the remaining swamp F019 sludge material
- Inst~~allation of a ground water monitoring system~~

The F019 sludge material from the swamp which is contaminated with PCBs greater than 500 ppm will be drummed in 30-gallon plastic drums as required by the off-site incineration facility. Exposure of on-site personnel to the site contaminants must be considered in all the removal steps for this alternative.

The remaining F019 sludge material in the swamp and the impoundment F019 sludge material will be removed and transported in bulk to the respective disposal facility.

Sufficient area is available on-site for the installation of the ground water treatment unit (if required). The on-site installation activities include foundation preparation, installation of the extraction wells, the chemical precipitation process, and the chemical oxidation/chlorination process. The reliability of this system depends largely on the operation and maintenance of the system.

A ground water monitoring system is installed and maintained to monitor the effectiveness of this alternative.

The time frame to complete Alternative 3 is as follows:

- Engineering Design - Approximately 12 months
- Remedial Activities - Approximately 4 to 6 months

Administrative Feasibility

The off-site incineration of the swamp F019 sludge contaminated with PCBs greater than 500 ppm will require approval from the incineration facility prior to the removal of this waste material. Currently, only a few facilities throughout the country are permitted to handle this type of waste material.

The off-site disposal whether by landfilling or by reclamation, recycling, or reuse will require approval from the respective facilities prior to the removal of both the impoundment sludge material and the remaining swamp F019 sludge which is contaminated with PCBs less than 500 ppm. These facilities will be required to have approval from state and federal agencies for handling the F019 sludge material.

Availability of Materials and Services

The necessary equipment and materials for this alternative are commonly available. The removal of the F019 sludge material from the swamp which is contaminated with PCBs should be removed by specialty contractors with experience in handling PCBs. The off-site incineration and disposal facilities are limited due to the types of waste material within this site. Availability of such facilities may be a significant factor in implementation of this alternative. The equipment used for implementing this technology is mostly standard construction equipment.

Cost

Capital and annual operating costs were estimated for Alternative 3. A present worth analysis was also conducted. Capital and base annual operating costs for this alternative are summarized in Table A1 of Appendix A.

Capital Costs

Capital costs for Alternative 3 include direct capital costs for the equipment, labor, and materials necessary for the removal and incineration of the F019 sludge contaminated with PCBs greater than 500 ppm; the removal and off-site disposal of the impoundment sludge; removal and off-site disposal of the remaining swamp sludge~~; and fence and compliance wells~~. Indirect capital costs for engineering and contingencies are also included. The total capital costs for this alternative is ~~$4,265,000~~.

Annual Costs

A.? ..t

Annual costs for this alternative are expected to include costs for monitoring and statistical analysis and maintenance and inspections. Costs are also included for a reevaluation of this alternative every five years, as required by SARA. Total annual costs are estimated to be ~~$76,000~~ per year.

Present Worth

A present worth analysis was calculated using a 5 percent inflation rate and a 10 percent discount factor over a 30-year period. The present worth value of this alternative is ~~$5,450,054~~.

Compliance With ARARs

Alternative 3 meets all the ARARs and TBCs, except those potentially related to ground water cleanup. The ARARs and TBCs pertaining to this alternative are summarized in Table 5-2 and Appendix B.

Overall Protection of Human Health and the Environment

This alternative combines complete source removal and treatment and considerably reduces any long-term impacts to human health and the environment. Any short-term impacts would be minimized by dust suppression measures. Source removal and the reduction of toxicity volume; would virtually eliminate the potential for human exposure to waste constituents. This alternative would provide adequate protection of public health and the environment.

State Acceptance

The state generally prefers that all the waste materials be removed from the 100-year floodplain which will be accomplished in this alternative.

Community Acceptance

Public concerns and comments will be addressed in the responsiveness summary and ROD.

5.2.4 Alternative 4 - Off-Site Treatment/Disposal Impoundment, Incinerate F019 Sludge in Swamp~~, and Monitor Ground Water~~

Short-Term Effectiveness

This alternative immediately satisfies the remedial goal by eliminating the contamination sources at the site and minimizing potential human exposure to F019 sludge contaminated with PCB.

Since this alternative is similar to Alternative 3, the short-term effects will be the same as discussed in Section 4.3.8, except that the removal of additional sludge containing less than 500 mg/kg of PCB sludge from the swamp area will significantly reduce the risk of PCB contact with human receptors.

Other components of this alternative such as excavation and off-site disposal of F019 sludge from impoundments, backfilling of impoundments with clean borrow material, ground/surface water controls ~~and monitoring,~~ and site management will have an immediate effect on potential reduction in contamination due to source removal potentially effecting human health risks.

Long-Term Effectiveness

This alternative provides long-term protection to human health and environment. Removal of F019 sludge and PCB material containing less than 500 mg/kg will eliminate the potential carcinogens from the site that have potential to migrate into the Tuscarawas River or come into contact with human receptors. Since waste will be removed from the site, no long-term engineering design and controls are necessary. ~~Security controls and~~ Surface water programs ~~(monitoring)~~ will eliminate residual contamination. This will result in significant long-term improvement in ground water and Tuscarawas River water quality.

Reduction of Toxicity, Mobility, or Volume

Alternative 4 is identical to Alternative 3, except that all F019 swamp wastes, in addition to high level PCB swamp sludges, will be excavated to F019 cleanup levels and incinerated. This option, therefore, results in a reduction of toxicity and mobility of impoundment wastes similar to Alternative 3. However, in addition to a reduction in toxicity of swamp wastes realized in Alternative 3, Alternative 4 would result in an additional reduction in volume.

Implementability

Implementation of Alternative 4 will require several construction activities including:

- Removal and off-site disposal of the F019 sludge material within the impoundment area
- Removal and off-site incineration of all the F019 sludge material within the swamp area
- ~~Installation of a ground water monitoring program.~~

All the F019 sludge material from the swamp which is contaminated with PCBs will be drummed in 30-gallon plastic drums as required by the off-site incineration facility. Exposure of on-site personnel to the site contaminants must be considered in all the removal steps for this alternative. The F019 sludge material within the impoundment area will be removed and transported in bulk to the respective disposal/reclamation facility.

A ground water monitoring system is installed and maintained to monitor the effectiveness of this alternative. The ground water treatment system is provided with monitoring controls to assure that the treated ground water meets the stipulated design requirements.

The time frame to complete Alternative 4 is as follows:

- Engineering Design - Approximately 12 months
- Remedial Action Activities - Approximately 4 to 6 months

Administrative Feasibility

The off-site incineration of all the F019 sludge within the swamp area will require approval from the incineration facility prior to the removal of this waste material.

The off-site disposal, whether by landfilling or by reclamation, recycling or reuse, will require approval from the respective facility prior to the removal of the F019 sludge material within the impoundment area. These facilities will be required to have approval from state and federal agencies for handling the F019 sludge material.

Availability of Materials and Services

The necessary equipment and materials for this alternative are commonly available. The removal of the F019 sludge material from the swamp area which is contaminated with PCBs should be removed by specialty contractors with experience in handling PCBs. The off-site incineration and disposal facilities required are limited due to the type of waste materials within this site. Availability of such facilities may be a significant factor in implementation of this alternative.

The equipment used for implementing this technology is mostly standard construction equipment. ~~The necessary equipment and materials for the ground water treatment system are also readily available.~~

Costs

Capital and annual operating costs were estimated for Alternative 4. A present worth analysis was also conducted. Capital and base annual operating costs for this alternative are summarized in Table A1 of Appendix A.

Capital Costs

Capital costs for Alternative 4 include direct capital costs for the equipment, labor, and materials necessary for the removal and off-site disposal of the impoundment sludge; removal and incineration of the swamp sludge~~; and fencing and compliance wells.~~ Indirect capital costs for engineering and contingencies are also included. The total capital costs for this alternative are $~~7,572,000.~~

Annual Costs

Annual costs for this alternative are expected to include costs for monitoring and statistical analysis, maintenance and inspections, and ground water treatment, if required. Costs are also included for a reevaluation of this alternative every five years, as required by SARA. Total annual costs are estimated to be $~~76,000~~ per year.

Present Worth

A present worth analysis was calculated using a 5 percent inflation rate and a 10 percent discount factor over a 30-year period. The present worth value of this alternative is $~~8,757,034~~.

Compliance With ARARs

Alternative 4 meets all the ARARs and TBCs, except those potentially related to ground water cleanup. The ARARs and TBCs pertaining to this alternative are summarized in Table 5-2 and Appendix B.

Overall Protection of Human Health and the Environment

Like Alternative 3, Alternative 4 combines source removal and treatment. With appropriate dust suppression measures, any short- and long-term impacts on potential human receptors and the surrounding environment would be greatly reduced. This alternative would provide adequate protection of human health and the environment.

State Acceptance

The state generally prefers that all the waste materials be removed from the 100-year floodplain which will be accomplished in this alternative.

Community Acceptance

Public concerns and comments will be addressed in the responsiveness summary and ROD.

5.2.5 Alternative 5 - On-Site Treatment/Landfill Impoundment, Incinerate Hot Swamp Materials, Off-Site Treatment/Disposal of Remaining F019 Sludge in Swamp, and Monitor Ground Water

Short-Term Effectiveness

This alternative of remedial action will have immediate short-term effects since F019 sludge containing in excess of 500 mg/kg PCBs will be excavated and transported and incinerated off site. Since low- and moderate-level PCB sludge will be transported to a permitted landfill, the residual PCB concentration will be significantly reduced, eliminating the potential for leaching and human contacts. During the excavation and removal of PCB sludge, there is a potential for worker dermal contact and/or inhalation exposure should the PCB material be airborne. Proper health and safety measures will reduce these risks to acceptable levels for the workers on site.

Pretreatment of F019 waste containing low to moderate PCBs will have no impact on the Gnadenhutten site since it will occur off site.

Complete removal of F019 sludge containing PCB will eliminate the potential for human contact or leaching/migration of PCB to ground water or the Tuscarawas River.

Treatment of impoundment waste on site by chlorination for cyanide and stabilization/solidification for metals into the mixing tanks will be environmentally safe, except for the potential for release of cyanide and organic vapors existing for sludge from the southern impoundment. Treatment of waste on site also presents the potential for dermal contact with F019 impoundment sludge containing arsenic and cyanide.

The chlorination techniques will significantly reduce the concentrations of cyanide in the sludge. Stabilization/solidification will effectively reduce the solubility and mobility of heavy metals. Further, the stabilization will entrap the heavy metals in Solid Matrix, thus potentially reducing the leachability of contaminants to ground water or the Tuscarawas River. Placement of stabilized material into a RCRA ~~vault~~ will immediately eliminate leachate generation.

During the construction of the landfill, there is a potential for worker dermal contact and/or inhalation exposure should the waste material become airborne. Proper health and safety measures will reduce these risks to acceptable levels for the workers on site. Once the waste material has been placed into the landfill and foam suppressant has been applied. This should reduce any further risk.

This alternative will have no environmental concern, except proper health and safety procedures should be used to avoid potential exposure to workers.

Long-Term Effectiveness

Sludge removal and disposal of above 500 mg/kg PCBs and moderate and low-level PCBs containing F019 sludge will be effective in the long-term effects as the contamination sources will be removed.

Chlorination of cyanide by sodium hypochlorite is a proven technology and will be effective in reducing cyanide concentration in the F019 impoundment sludge. Stabilization/solidification of metal sludges by a lime-based solidification technique to reduce metal solubility, mobility, and structural permeability into a monolithic mass is a demonstrated technique for handling metal waste. The production of monolithic mass and subsequent emplacement into a RCRA-type vault with clay and synthetic liners and a leak and leachate collection is a proven technique accepted by U.S. EPA for landfill disposal of the hazardous waste. Further, the RCRA-type multilayer cap will eliminate leaching through surface infiltration.

Other site management systems including ground and surface water management, limited use of site, and maintenance of a RCRA vault and ground water monitoring system will provide long-term protection to the environment and human health.

Reduction of Toxicity, Mobility, or Volume

Alternative 5 employs Alternative 3 technology, except an on-site RCRA landfill instead of an off-site landfill will be used to dispose of treated impoundment wastes.

This option results in a reduction of impoundment waste toxicity and mobility. As in Alternative 3, the swamp wastes with PCB levels greater than 500 mg/kg will be incinerated and, thereby, be reduced in both toxicity and volume. The remaining F019 swamp sludges will be excavated to cleanup levels, detoxified, and solidified prior to disposal. This will result in a reduction in toxicity and mobility, but will not result in a reduction in volume as in Alternative 4, in which all swamp materials are incinerated.

Implementability

Implementation of Alternative 5 will require several construction activities, including:

- Removal and on-site landfill (~~RCRA-type vault~~) of the F019 sludge material within the impoundment area
- Removal and off-site incineration of the F019 sludge material within the swamp area which is contaminated with PCBs greater than 500 ppm
- Removal and off-site disposal of the remaining F019 sludge material within the swamp area
- Installation of ground water monitoring program

An on-site landfill (~~RCRA-type vault~~) will be constructed within the site boundaries. This landfill is to be elevated to remove the waste material from the 100-year floodplain. The 100-year floodplain for this site is any area which is below the ~~830~~ MSL elevation. ~~The construction of aboveground RCRA-type vaults is a common mechanism for containing hazardous waste.~~ The RCRA-~~type vault~~ provides the following:

- Isolates the waste materials from the ground water
- Isolates the waste materials from the surface environment and human contact

The F019 sludge material from the swamp area which is contaminated with PCBs greater than 500 ppm will be containerized in 30-gallon plastic drums as required by the off-site incineration facility. Exposure of personnel to the site contaminants must be considered in all of the removal steps for this alternative.

The remaining F019 sludge material in the swamp area will be removed, containerized, and transported to the respective disposal/reclamation facility.

A ground water monitoring system is installed and maintained to monitor the effectiveness of this alternative. ~~The ground water treatment system is provided with monitoring controls to assure that the treated ground water meets the stipulated design requirements.~~

The time frame to complete Alternative 5 is as follows:

- Engineering Design - Approximately 12 months
- Remedial Action Activities - Approximately 6 to 9 months

Administrative Feasibility

The off-site incineration of the F019 sludge material from the swamp area which is contaminated with PCBs greater than 500 ppm will require approval from a permitted incineration facility prior to the removal of this waste material. Currently, only a few facilities throughout the country are permitted to incinerate this type of waste material.

The off-site disposal, whether by landfilling or reclamation, recycling or reuse, will require approval from the respective facility prior to the removal of this waste material.

Availability of Material and Services

The necessary equipment and materials for this alternative are commonly available. The removal of the F019 sludge material from the swamp area which is contaminated with PCBs should be removed by specialty contractors with experience in handling PCBs. In addition, the on-site landfill (~~RCRA-type vault~~) should also be constructed by specialty contractors.

The off-site incineration and disposal facilities are limited in number due to the types of waste materials within the swamp area of this site. Availability of such facilities may be a significant factor in implementation of this alternative.

The equipment used for implementing this alternative is mostly standard construction equipment. The necessary equipment and materials for the ground water treatment system are also readily available.

Cost

Capital and annual operating costs were estimated for Alternative 5. A present worth analysis was also conducted. Capital and base annual operating costs for this alternative are summarized in Table A1 of Appendix A.

Capital Costs

Capital costs for Alternative 5 include direct capital costs for the equipment, labor, and materials necessary for the removal, treatment, and on-site disposal of the impoundment sludge; removal and off-site incineration of the swamp sludge contaminated with PCBs greater than 500 ppm; removal and off-site disposal of the remaining swamp sludge; and fencing and compliance wells. Indirect capital costs for a treatability study for the F019 sludge treatment, engineering, and contingencies are also included. The total capital costs for this alternative are $5,116,000.

Annual Costs

Annual costs for this alternative are expected to include costs for monitoring and statistical analysis, maintenance and inspections, and ground water monitoring. Costs are also included for a reevaluation of this alternative every five years, as required by SARA. Total annual costs are estimated to be $121,000 per year.

Present Worth

A present worth analysis was calculated using a 5 percent inflation rate and a 10 percent discount factor over a 30-year period. The present worth value of this alternative is $7,002,730.

Compliance With ARARS

Alternative 5 does not meet all of the ARARs and TBCs determined applicable for the Alsco-Anaconda NPL site. The ARARs and TBCs pertaining to this alternative are summarized in Table 5-2 and Appendix B.

~~The major ARARs that this alternative will not comply with are:~~

- ~~Ohio House~~ Bill No. 592 which does ~~not allow waste~~ materials to ~~remain in~~ an area where a useable aquifer is located

- As previously discussed in this report, ground water will be investigated as a separate oeprable unit; therefore, the alternative will not meet the MCLs or a cumulative cancer risk of greater than 10^{-4} to 10^{-7}, whichever is more stringent

The pertinent landfill requirements will be addressed concerning the construction of the ~~RCRA-type~~ on-site ~~vault~~. The ~~vault~~ will consist of a cap which has been designed as a multilayer system composed of a topsoil and vegetative layer, a drainage layer, and a low-permeability layer (clay and synthetics). The primary function provided by this ~~vault~~ cap is the minimization of infiltration into the waste materials. A drainage layer will be provided to collect infiltrated water prior to entering the liner layer. The compacted clay layer is designed for permeability of less than or equal to 1×10^{-7} cm/s, and the synthetic liner would allow virtually no liquid penetration. The clay layer provides assurance of continued protection if the synthetic liner should fail. Additionally, the ~~vault~~ cap will be graded to promote runoff and to prevent ponding of water on the cap surface. Storm water management is addressed with a system of diversion and drainage ditches and catch basins.

This alternative includes maintenance of the ~~vault~~ cap to ensure the integrity and effectiveness. The ~~vault~~ will be inspected on a regular basis for signs of erosion, settlement, or subsidence. Any signs of unexpected settling or subsidence would be addressed immediately.

Since the ~~source~~ of contamination will be removed, ~~the ground~~ water quality over a period of time ~~will achieve compliance~~ with ARARs and TBCs relating to ground water requirements.

A deed restriction would be placed on the Alsco-Anaconda NPL site to control future use of the property. Use of the property is recorded in the deed to the property.

A site monitoring program will be established ~~to indicate when levels of ground water cleanup have been achieved~~. The program includes upgradient and downgradient wells. Site monitoring is ~~also~~ conducted to ensure the effectiveness of the alternative.

Overall Protection of Human Health and the Environment

Alternative 5 represents a significant reduction in both short- and long-term impacts on human health and the environment, similar to Alternative 3. Potential exposure to waste constituents would be virtually eliminated, except for the potential future impacts due to the on-site RCRA landfill.

State Acceptance

The state generally prefers that all the waste materials be removed from the 100-year floodplain.

Community Acceptance

Public concerns and comments will be addressed in the responsiveness summary and ROD.

5.2.6 Alternative 6 - On-Site Treatment/Landfill Impoundment, Incinerate Swamp Materials, and Monitor Ground Water

Short-Term Effectiveness

Complete removal of swamp materials containing PCB from the site will immediately eliminate potential carcinogenic risks to human receptors. This will also eliminate the potential for PCB leaching to ground water and the Tuscarawas River.

During excavation/removal of swamp sludge, there is a potential risk to workers to come in dermal contact or inhalation of PCB material; however, proper health and safety measures can reduce the risks to acceptable levels.

Short-term effectiveness of on-site treatment and landfill disposal of F019 sludge is discussed in Section 5.2.5.

Long-Term Effectiveness and Permanence

Removal of swamp material containing PCBs will be effective over the long-term in reducing the environmental and human health risks. The potential for PCB leaching to ground water and the Tuscarawas River will be completely eliminated.

Design controls for on-site treatment/RCRA vault emplacements for treated impoundment materials are discussed in Section 4.5.1.

Reduction of Toxicity, Mobility, or Volume

Alternative 6 is similar to Alternative 5, with the exception of the swamp wastes. All swamp waste excavated to F019 cleanup levels is incinerated.

Treatment and disposal in an on-site RCRA landfill will reduce the toxicity and mobility of impoundment wastes. Incineration of all swamp waste excavated to F019 cleanup levels would result in a significant reduction in toxicity and volume. The reduction in waste volume is identical to that in Alternative 4 and greater than the reduction that would result from Alternative 5.

Implementability

Implementation of Alternative 6 will require several construction activities, including:

- Removal and on-site landfill (~~RCRA type vault~~) of the F019 sludge material within the impoundment area
- Removal and off-site incineration of all of the F019 sludge material within the swamp area
- Installation of ground water monitoring program

An on-site landfill ~~(RCRA-type vault)~~ will be constructed within the site boundaries. This landfill is to be elevated to remove the waste materials from the 100-year floodplain. The 100-year floodplain for this site is any area which is below the 830 MSL elevation. Th~~e construction of aboveground RCRA-type vaults is a common mechanism for containing hazardous waste.~~ The RCRA~~-type vaul~~t provides the following:

- Isolates the waste materials from the ground water
- Isolates the waste materials from the surface environment and human contact

The F019 sludge material from the swamp area will be removed, containerized, and transported as required by the off-site incineration facility. Exposure of personnel to the site contaminants must be considered in all of the removal steps for this alternative.

A ground water monitoring system is installed and maintained to monitor the effectiveness of this alternative. ~~The ground water treatment system is provided with monitoring controls to assure that the treated ground water meets the stipulated design requirements.~~

A time frame to complete Alternative 6 is as follows:

- Engineering Design - Approximately 12 months
- Remedial Action Activities - Approximately 6 to 9 months

Administrative Feasibility

The off-site incineration of all of the F019 sludge material in the swamp area will require approval from a permitted incineration facility prior to the removal of this waste material. In respect to the sludge material contaminated with PCBs greater than 500 ppm, only a few facilities throughout the country are permitted to incinerate this type of waste material.

Availability of Materials and Services

The necessary equipment and materials for this alternative are commonly available. The removal of the F019 sludge material from within the swamp area should be removed by specialty contractors with experience in handling PCBs.

In addition, the on-site landfill ~~(RCRA-type vault)~~ should also be constructed by specialty contractors.

The off-site incineration facility is limited due to the type of waste material within the swamp area of this site. Availability of such a facility may be a significant factor in implementation of this alternative.

The equipment used for implementing this alternative is mostly standard construction equipment. The necessary equipment and materials for the ground water treatment system are also readily available.

Cost

Capital and annual operating costs were estimated for Alternative 6. A present worth analysis was also conducted. Capital and base annual operating costs for this alternative are summarized in Table A1 of Appendix A.

Capital Costs

Capital costs for Alternative 6 include direct capital costs for the equipment, labor, and materials necessary for the removal, treatment, and on-site disposal of the impoundment sludge; removal and off-site incineration of all the swamp sludge; and fencing and compliance wells for ground water monitoring. Indirect capital costs for a treatability study for the F019 sludge treatment, engineering, and contingencies are also included. The total capital costs for this alternative are $7,055,000.

Annual Costs

Annual costs for this alternative are expected to include costs for monitoring and statistical analysis, maintenance and inspections, and ground water monitoring. Costs are also included for a reevaluation of this alternative every five years, as required by SARA. Total annual costs are estimated to be $121,000 per year.

Present Worth

A present worth analysis was calculated using a 5 percent inflation rate and a 10 percent discount factor over a 30-year period. The present worth value of this alternative is $8,941,730.

Compliance With ARARs

Alternative 6 will not meet all of the ARARs and TBCs determined applicable for the Alsco-Anaconda NPL site. The ARARs and TBCs pertaining to this alternative are summarized in Table 5-2 and Appendix B.

The major ARARs that this ~~alternative will~~ not comply with are:

- Ohio House Bill No. 592 which does not allow waste materials to remain in an area ~~where a useable aquifer is~~ located

- As previously discussed in this report, ground water will be investigated as a separate oeprable unit; therefore, the alternative will not meet the MCLs or a cumulative cancer risk of greater than 10^{-4} to 10^{-7}, whichever is more stringent

Overall Protection of Human Health and the Environment

The technologies employed in Alternative 6 would reduce the toxicity and mobility impoundment waste constituents. However, the potential for future impacts to human receptors and the surrounding environment from an on-site RCRA landfill exists. This action, therefore, meets remedial action goals and protects human health and the environment, but does not do so to the extent of the Alternative 3 impoundment waste management action.

Excavation of all swamp wastes to F019 cleanup levels for treatment/disposal by incineration will essentially eliminate the potential for human exposure to swamp waste constituents. With adequate short-term controls, this action will meet the remedial action goals for the protection of human health and the environment.

State Acceptance

The state generally prefers that all waste materials be removed from the 100-year floodplain.

Community Acceptance

Public concerns and comments will be addressed in the responsiveness summary and ROD.

5.2.7 Alternative 9 - On-Site Treatment/Landfill Impoundment, Incinerate Hot Swamp Material, On-Site Treatment/Landfill Remaining F019 Sludge in Swamp, and Monitor Ground Water

Short-Term Effectiveness

Short-term effectiveness of this alternative is similar to that discussed in Section 4.5.1. Removal of hot swamp F019 sludge exceeding 500 mg/kg of PCBs will partially eliminate the human health risks. Placement of F019 swamp sludge containing less than 500 mg/kg PCBs will reduce the risk of leaching and migration of PCBs to ground water or the Tuscarawas River.

Removal of PCB-contaminated F019 waste and on-site treatment of low-level PCB sludge from the swamp area has potential for contact or inhalation exposure to workers; however, with proper health and safety measures, the risks can be reduced to acceptable levels. Placement of F019 swamp sludge in a RCRA-type vault will immediately reduce the risk of leaching/migration and eliminate potential human health risks.

Short-term effectiveness of on-site treatment and landfill disposal of F019 sludge is discussed in Section 5.2.5.

Long-Term Effectiveness and Permanence

This remedial alternative will reduce long-term risks for human health. The RCRA-~~type vault~~ is a proven technique to manage hazardous waste in landfills. Both the multilayer cap and liner with leachate collection/monitoring system will provide long-term remediation and protection to environment and human health. Engineering designs for RCRA va~~ult~~ is discussed in Section 4.5.1.

Reduction of Toxicity, Mobility, or Volume

Alternative 9 is identical to Alternative 5 with the exception of remediation of swamp materials. As in Alternative 5, the impoundment waste toxicity and mobility are reduced by oxidation and stabilization/solidification. However, the swamp sludges, after removal of waste with PCB levels greater than 500 mg/kg, will be treated and disposed of in a RCRA cell adjacent to impoundment materials. This will result in a reduction of the toxicity and mobilization through oxidation stabilization and solidification, which is used for the impoundment sludges. A significant reduction in volume would not be realized.

Implementability

Implementation of Alternative 9 will require several construction activities:

- Removal and on-site landfill ~~(RCRA type vault)~~ of the F019 sludge material within the impoundment area

- Removal and off-site incineration of the F019 sludge material within the swamp area which is contaminated with PCBs greater than 500 ppm

- Removal and on-site landfill (~~RCRA-type vault~~) of the remaining F019 sludge material from the swamp area

An on-site landfill (~~RCRA-type vault~~) will be constructed within the site boundaries. This landfill is to be elevated to remove the waste materials from the 100-year floodplain. The 100-year floodplain for this site is any area which is below the 830 MSL elevation. This ~~vault~~ is to be constructed with two separate cells which will contain the following:

- F019 sludge material from the impoundment area

- F019 sludge material from the swamp area which is contaminated with PCBs less than 500 ppm

This segregation is to eliminate the mixing of these two waste materials to enable retrieval, if required. ~~The construction of aboveground RCRA-type vaults is a common mechanism for containing hazardous waste.~~ The RCRA~~-type vault~~ provides the following:

- Isolates the waste materials from the ground water

- Isolates the waste materials from the surface environment and human contact

The F019 sludge material from the swamp area which is contaminated with PCBs greater than 500 ppm will be containerized in 30-gallon drums as required by the off-site incineration facility. Exposure of personnel to the site contaminants must be considered in all of the removal steps for this alternative.

A ground water monitoring system is installed and maintained to monitor the effectiveness of this alternative. ~~The ground water treatment system is provided with monitoring controls to ensure that the ground water meets the allowable limits.~~

The time frame to complete Alternative 9 is as follows:

- Engineering Design - Approximately 12 months
- Remedial Action Activities - Approximately 6 to 12 months

Administrative Feasibility

The off-site incineration of the F019 sludge material from the swamp area which is contaminated with PCBs greater than 500 ppm will require approval for a permitted incineration facility prior to the removal of this waste material. Currently, only a few facilities throughout the country are permitted to incinerate this type of waste material.

Availability of Materials and Services

The necessary equipment and materials for this alternative are commonly available. The removal of the F019 sludge material from the swamp area which is contaminated with PCBs should be removed by specialty contractors with experience in handling PCBs. In addition, the on-site landfill (~~RCRA-type vault~~) should also be constructed by speciality contractors.

The off-site incineration is limited in number due to the type of waste material. Availability of such a facility may be a significant factor in implementation of this alternative.

The equipment used for implementing this alternative is mostly standard construction equipment.

Cost

Capital and annual operating costs were estimated for Alternative 9. A present worth analysis was also conducted. Capital and base annual operating costs for this alternative are summarized in Table A1 of Appendix A.

Capital Costs

Capital costs for Alternative 9 include direct capital costs for the equipment, labor, and materials necessary for the removal and incineration of the swamp sludge contaminated with PCBs greater than 500 ppm; removal, treatment, and on-site landfill of remaining swamp sludge; removal, treatment, and on-site landfill of the impoundment sludge; and fencing and compliance wells for ground water monitoring. Indirect capital costs for treatability study for the F019 sludge treatment, engineering, and contingencies are also included. The total capital costs for this alternative are $2,817,000.

Annual Costs

Annual costs for this alternative are expected to include costs for monitoring, maintenance and inspections, and ground water monitoring. Costs are also included for a reevaluation of this alternative every five years, as required by SARA. Total annual costs are estimated to be $127,000 per year.

Present Worth

A present worth analysis was calculated using a 5 percent inflation rate and a 10 percent discount factor over a 30-year period. The present worth value of this alternative is $4,797,287.

Compliance With ARARs

Alternative 9 will not meet all of the ARARs and TBCs determined applicable for the Alsco-Anaconda NPL site. The ARARs and TBCs pertaining to this alternative are summarized in Table 5-2 and Appendix B.

~~The major ARARs that this alternative will not comply with are:~~

- ~~Ohio House Bill No. 592 which does not allow waste materials~~ to remain in an ~~area where a~~ useable ~~aquifer is located.~~

- As previously discussed in this report, ground water will be investigated as a separate oeprable unit; therefore, the alternative will not meet the MCLs or a cumulative cancer risk of greater than 10^{-4} to 10^{-7}, whichever is more stringent

Overall Protection of Human Health and the Environment

The source treatment/containment technologies employed in Alternative 9 would meet human health and environmental protection goals by detoxifying waste remaining on site. On-site disposal represents a greater potential for future impacts to the surrounding potential receptors and the environment than off-site disposal. Therefore, this alternative, while still protecting public health, does not afford the same level of protection as Alternative 4.

State Acceptance

The state generally prefers that all waste materials be removed from the 100-year floodplain.

Community Acceptance

Public concerns and comments will be addressed in the responsiveness summary and ROD.

6.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

Each of the seven alternatives retained for detailed analysis have been assessed individually against the nine evaluation criteria discussed in Chapter 5.0. The purpose of this chapter is to present a comparative analysis that identifies the relative advantages and disadvantages of each alternative.

Overall Protection of Human Health and the Environment

All of the alternatives, except Alternative 1 (no action), provide adequate protection of human health and the environment. Risk through direct contact is reduced to less than established standards, cancer risk levels less than 1 x 10^{-6}, + less than reference [illegible]. Ground water will be investigated as a separate operable unit at a later time.

Alternative 2 achieves protection by preventing exposure through the following:

- Capping
- Slurry wall
- Flood berm

The [illegible] alternatives [illegible] complete source removal & [illegible] protection to human health + the environment, but differ in [illegible]

Al~~ternatives~~ 3 and 4 reduce risks posed by all portions of the site ~~through~~ treatment while Alternatives 5, 6, ~~and~~ 9 reduce risk through a containment and treatment combination.

Incineration of the F019 sludge contaminated with PCBs may result in a hazardous waste residue which would have to be disposed in a hazardous waste landfill. Where appropriate, all waste materials will be reclaimed, reused, and/or recycled to eliminate any potential harm to human health and the environment.

Compliance With ARARs

The evaluation of the ability of the alternatives to comply with ARARs included a review of contaminant-specific, action-specific, and location-specific ARARs.

Alternatives 1, 2, 5, 6, and 9 do not meet all of their respective ARARs, whereas Alternatives 3 and 4 do meet their respective ARARs. This ARAR comparison is presented in Chapter 5.0, Table 5.2 of this FS report.

Long-Term Effectiveness

Alternatives 3 and 4 afford the highest degrees of long-term effectiveness and permanence because both alternatives use treatment technologies to reduce hazards posed by the waste materials at the site. These two alternatives differ only in the technology used to treated the waste materials in the swamp. Both alternatives reduce the risks posed by the waste materials to a 10^{-6} cancer risk level.

Alternative 2 would rely on a soil/clay/synthetic liner cap to control infiltration, a reliable technology if properly maintained. In addition, Alternative 2 would also employ a slurry wall and extraction wells to divert any ground water from exposure to the waste materials. Upon completion, long-term maintenance of the cap and berm would be required until the alternative has met the health-based cleanup level, at which time the monitoring can be eliminated.

Alternative 2 leaves most of the contaminated waste material at site and relies solely upon a cap and institutional controls to prevent exposure. This alternative also has a long-term ground water monitoring and cap maintenance requirements (mowing, revegetation, cap repair, etc.) which are more critical for the effectiveness of the alternative since most of the waste materials (without any typer of treatment to reduce their mobility, toxicity, or volume) remain at the site under the cap.

Alternatives 5, 6, and 9 afford a higher degree of long-term effectiveness and permanence than Alternative 2 since treatment technologies are used to reduce hazards posed at the site F019 sludge contaminated with PCBs greater than 500 mg/kg and the remaining F019 sludge contaminated with PCB in Alternatives 5 and 6, these alternatives leave a majority of the waste materials (treated) on site and rely on an on-site landfill and institutional controls to prevent exposure. The long-term landfill operations and maintenance requirements are critical factors in the effectiveness of these alternatives over the long-term.

Reduction of Toxicity, Mobility, or Volume of the Waste

Alternatives 3, 4, 5, 6, and 9 use treatment technologies to reduce the inherent hazards posed by the waste materials at the site. All of these alternatives would treat and incinerate in various combinations all waste materials posing more than a 10^{-6} excess cancer risk level by ingestion.

Alternative 2 uses only a treatment technology on the F019 sludge contaminated by PCBs greater than 500 mg/kg. The remaining waste materials are controlled by a cap.

Short-Term Effectivess

Alternative 2 is anticipated to have the greatest short-term effectiveness. The alternative presents the least amount of risk to workers, the community, and the environment. Particulate emissions are anticipated in the removal of the greater than 500 mg/kg PCB-contaminated waste materials and the cap and slurry wall installation; however, dust control methods should reduce this risk.

Alternatives 3, 4, 5, 6, and 9 have a greater potential for relasing waste materials into the atmosphere during excavation activities. In addition, the movement of the waste materials both on site and off site will increase the risks during the implementation of these alternatives.

Implementability

Alternatives 3 and 4 will be the simplest to implement since there will be no on-site containment. The availability on both approved off-site incineration and disposal facilities (both landfills and reclamation/reuse/recycle facilities) may require extensive predisposal requirements.

Alternative 2 would require readily available engineering services and cap/slurry wall materials. If additional contamination is discovered during remedial activities at the site, the expansion of the cap/slurry wall could incorporate these areas of concern. Periodic maintenance of the cap should control its reliability in the future.

Alternatives 5, 6, and 9 are more complex than Alternative 2 because of the on-site fixation of the waste materials and the installation of an on-site landfill. Both activities would require additional construction techniques that would have to be supplied by specialists. Additional treatability studies would be required to optimize the reagent doses.

Cost

Alternative 2 has a lower capital ($1,637,000) and present worth ($2,962,389) than any of the other alternatives. Alternative 4 has a higher capital ($7~~,572,~~000 versus $4~~,265,~~000) and present worth ($8~~,757,0~~54 versus $5,450,054) cost than Alternative 3 because of the incineration component which incinerates all of the PCB contaminated F019 sludge within the swamp. Alternative 6 has a higher capital ($7,055,000 versus $5,116,000) and present worth ($8,941,730 versus $7,002,730) cost than Alternative 5 because of the same reason discussed between Alternatives 3 and 4. The capital cost for Alternative 9, which on-site landfills all of the waste materials except the PCB-contaminated F019 sludge greater than 500 mg/kg, is $2,817,000. The cost details of all the alternatives are included in Appendix A of this report.

State Acceptance

This item is to be addressed in the ROD. The state generally prefers that all of the waste materials be removed from the 100-year floodplain.

Community Acceptance

This item is to be addressed in the ROD.

TABLES

TABLE 2.1

REMEDIAL RESPONSE ACTIONS
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

OPERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION
Impoundment and swamp areas	No action	None	None
	Access restriction	Fencing Deed restriction	
	Surface stabilization	Dust control	Capping
		Sediment control barrier	Cofferdam Curtain barrier Revegetation
	Containment	Horizontal barriers	Block displacement Grout injection
		Vertical barriers	Soil-bentonite slurry wall Cement-bentonite slurry wall Grout curtain Sheet piling Vibrating beam wall
		Capping	Clay Asphalt Concrete Gravel/clay Soil/clay Soil/synthetic liner Soil/synthetic liner/clay
		Surface water control	Diversion/collection Grading Soil stabilization

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TABLE 2.1
(Continued)

OPERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION
Impoundment and swamp areas (cont.)	Removal	Mechanical transportation	-
	Off-site landfill	-	
	On-site landfill	-	-
	On-site control/treatment	Biological treatment	In situ biodegradation On-site landfarming
		Solidification/stabilization	Cement-based Thermoplastics Organic polymer Classification Lime-based
		Physical/chemical treatment	Fluidized bed combustor Infrared incinerator Rotary incinerator Pyrolitic incinerator Fluidized bed incinerator Cement or lime kiln incinerator Multiple hearth incinerator Molten salt incinerator High-temperature fluid wall incinerator Plasma arc incinerator Circulating bed incinerator Industrial boiler/furnace Microwave plasma incinerator Thermal desorption Soil aeration Soil washing Injection/grouting (in situ) Virtrification Solvent extraction

TABLE 2.1
(Continued)

OPERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION
Impoundment and swamp areas (cont.)	Off-site treatment	Thermal destruction	Incineration
		Biological treatment	Landfarming

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TABLE 2.2

SUMMARY OF SCREENED REMEDIAL TECHNOLOGIES FOR DEVELOPMENT OF REMEDIAL ALTERNATIVES ALSCO-ANACONDA NPL SITE GNADENHUTTEN, OHIO

OPERABLE UNITS

TECHNOLOGY	IMPOUNDMENTS AND SLUDGE PIT	SWAMP MATERIALS	GROUND WATER
No Action	*	*	
Access Restriction	*	*	
Mon~~itoring~~			*
Soil-Bentonite Slurry Walls	*	*	
Soil-Synt~~hic~~ Liner, Clay Cap	*	*	
Lime-Based Solidification/ Stabilization	*	*	
On-Site Landfill	*	*	
Off-Site Landfill	*	*	
Incineration		*	
On-Site Treatment			
Recovery Wells			
POTW			
Surf~~ace Water Discharge~~			

TABLE 3.1

PRELIMINARY REMEDIAL ACTION ALTERNATIVES
FEASIBILITY STUDY
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

NO.	RESPONSE ACTION	IMPOUNDMENT[a]	SWAMP	GROUND WATER
1.	No Action	• Fencing • Deed restrictions	• Fencing • Deed restrictions	Monitoring
2.	Containment	• Consolidation • Cap Treat/monitor [illegible] Berm to be constructed to prevent flooding of NPL site	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Cap and slurry wall remaining PCB-contaminated F019 sludge	Monitoring
3.	Treatment	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • Off-site disposal	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Removal, pretreatment/treatment, and off-site disposal of remaining F019 sludge to cleanup levels	Monitoring
4.	Treatment	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • Off-site disposal	• Removal and incineration of all sludge contaminated with PCB to cleanup	Monitoring

See footnote at end of table.

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TABLE 3.1
(Continued)

NO.	RESPONSE ACTION	IMPOUNDMENT[a]	SWAMP	~~GROUND WATER~~
5.	Treatment	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • On-site RCRA ~~vault~~	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Removal, pretreatment/treatment, and off-site disposal of remaining F019 sludge to cleanup levels	Moni~~toring~~
6.	Treatment	Monitor ground water • Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • On-site RCRA ~~vault~~	• Removal and incineration of all F019 sludge contaminated with PCB to cleanup levels	Monitoring
7.	Combination No. 1	monitor ground water • Consolidation • Cap	• Removal and incineration of all F019 sludge contaminated with PCB to cleanup levels	~~Monitoring~~
		Berm to be constructed to prevent flooding of NPL site Monitor ground water		
8.	Combination No. 2	• Consolidation • Cap	• Removal and incineration of all F019 sludge contaminated with PCB above the PCB cleanup level • Removal, pretreatment/treatment, and off-site disposal of remainign F019 sludge contaminated with PCB to F019 sludge cleanup level	~~Monitoring~~
		Berm to be constructed to prevent flooding of NPL site monitor groundwater		

See footnote at end of table.

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TABLE 3.1
(Continued)

NO.	RESPONSE ACTION	IMPOUNDMENT[a]	SWAMP	GROUND WATER
9.	Combination No. 3	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • On-site RCRA vault	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Removal, pretreatment/treatment, and on-site RCRA vault of F019 sludge contaminated with PCB to cleanup levels	~~Monitoring~~

monitor ground water

[a]Impoundment includes the northern and southern impoundments and the sludge pit.
Note: Unless otherwise stated, cleanup levels refer to both the PCB and F019 sludge cleanup levels.

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TABLE 3.2
SUMMARY OF REMEDIAL ACT... ALTERNATIVE INTIAL SCREENING
FEASIBILITY STUDY
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

Screening Criteria
EFFECTIVENESS

ALTERNATIVE NUMBERS	RESPONSE ACTION	IMPOUNDMENT *(I)	SWAMP (S)	GROUNDWATER (GW)	Short-Term Protectiveness of Human Health			Long-Term Protectiveness of Human Health			Short-Term Protectiveness of Environment			Long-Term Protectiveness of Environment			Reduction of Mobility, Toxicity or Volume of Waste		
					I	S	GW	I	S	GW	I	S	GW	I	S	GW	I	S	GW
1.	No Action	o Fencing o Deed Restrictions	o Fencing o Deed Restriction	o Monitoring	4	2	5	3	2	4	4	2	5	3	2	[illegible]	1	1	[illegible]
2.	Containment	o Consolidation o Cap	o Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm. o Cap and slurry wall remaining PCB contaminated F019 sludge	o Monitoring	3	2	5	4	4	4	3	2	5	4	2	4	1	4	[illegible]
		Berm to be constructed to prevent flooding of NPL Site. Treat/monitor ground water																	
3.	Treatment	o Removal of all F019 Sludge to the F019 cleanup level o Pretreat/Treat o Off-site disposal	o Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm. o Removal, pretreat/treat and off-site disposal of remaining F019 sludge to cleanup levels.	o Monitoring	2	2	5	5	5	4	2	2	5	5	5	4	3	4	[illegible]
4.	Treatment	o Removal of all F019 Sludge to the F019 cleanup level o Pretreat/Treat o Off-site disposal	o Removal and incineration of all F019 sludge contaminated with PCB to cleanup levels.	o Monitoring	2	2	5	5	5	4	2	2	5	5	5	4	3	5	[illegible]
5.	Treatment	o Removal of all F019 Sludge to the F019 cleanup level o Pretreat/Treat o On-site RCRA Vault	o Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm. o Removal, pretreat/treat and off-site disposal of remaining F019 sludge to cleanup levels.	o Monitoring	3	2	5	5	5	4	3	2	5	5	5	4	3	4	[illegible]
		monitor ground water																	
6.	Treatment	o Removal of all F019 Sludge to the F019 cleanup level o Pretreat/Treat o On-site RCRA Vault	o Removal and incineration of all F019 sludge contaminated with PCB to cleanup levels.	o Monitoring	3	2	5	5	5	4	3	2	5	5	5	4	3	5	[illegible]
7.	Combination#1	o Consolidation o Cap	o Removal and incineration of all F019 sludge contaminated with PCB to cleanup levels.	o Monitoring	3	2	5	4	5	4	3	2	5	4	5	4	1	5	[illegible]
		Berm to be constructed to prevent flooding of NPL Site. monitor ground water																	
8.	Combination#2	o Consolidation o Cap	o Removal and incineration of all F019 sludge contaminated with PCB above the PCB cleanup level. o Removal, pretreat/treat and off-site disposal of remaining F019 sludge contaminated with PCB to the F019 cleanup level.	o Monitoring	3	2	5	4	5	4	3	2	5	4	5	4	1	4	[illegible]
		Berm to be constructed to prevent flooding of NPL Site.																	
9.	Combination#3	o Removal of all F019 Sludge to the F019 cleanup level o Pretreat/Treat o On-site RCRA Vault	o Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm. o Removal, pretreat/treat and on site RCRA vault of F019 sludge contaminated with PCB to cleanup levels.	o Monitoring	3	2	5	5	5	4	3	2	5	5	5	4	3	4	[illegible]

* Impoundment includes the Norhtern and Southern Impoundments and the sludge pit.

00002147

TABLE 3.2 (CONT)

Monitor ground water

ALTERNATIVE NUMBERS	RESPONSE ACTION	IMPOUNDMENT *(I)	SWAMP (S)	GROUNDWATER (GW)	IMPLEMENTABILITY: Technical Feasibility I	S	GW	Administrative Feasibility I	S	GW	Total Score
1.	No Action	o Fencing o Deed Restrictions	o Fencing o Deed Restriction	o Monitoring	5	5	5	4	4	4	70
2.	Containment	o Consolidation o Cap	o Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm. o Cap and slurry wall remaining PCB contaminated F019 sludge	o Monitoring	4	2	5	2	2	5	68
		Berm to be constructed to prevent flooding of NPL Site.									
3.	Treatment	[illegible] groundwater o Removal of all F019 Sludge to the F019 cleanup level o Pretreat/Treat o Off-site disposal	o Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm. o Removal, pretreat/treat and off-site disposal of remaining F019 sludge to cleanup levels.	o Monitoring	4	3	5	3	3	5	77
4.	Treatment	o Removal of all F019 Sludge to the F019 cleanup level o Pretreat/Treat o Off-site disposal	o Removal and incineration of all F019 sludge contaminated with PCB to cleanup levels.	o Monitoring	4	3	5	3	4	5	79
5.	Treatment	o Removal of all F019 Sludge to the F019 cleanup level o Pretreat/Treat o On-site RCRA Vault	o Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm. o Removal, pretreat/treat and off-site disposal of remaining F019 sludge to cleanup levels.	o Monitoring	3	3	5	3	3	5	78
6.	Treatment	o Removal of all F019 Sludge to the F019 cleanup level o Pretreat/Treat o On-site RCRA Vault	o Removal and incineration of all F019 sludge contaminated with PCB to cleanup levels.	o Monitoring	3	3	5	3	4	5	80
7.	Combination#1	o Consolidation o Cap	o Removal and incineration of all F019 sludge contaminated with PCB to cleanup levels.	o Monitoring	4	3	5	2	4	4	[illegible]
		Berm to be constructed to prevent flooding of NPL Site.									
8.	Combination#2	o Consolidation o Cap	o Removal and incineration of all F019 sludge contaminated with PCB above the PCB cleanup level. o Removal, pretreat/treat and off-site disposal of remaining F019 sludge contaminated with PCB to the F019 cleanup level.	o Monitoring	4 4	3 3	5 5	2 2	4 3	4 5	[illegible] 74
		Berm to be constructed to prevent flooding of NPL Site.									
9.	Combination#3	o Removal of all F019 Sludge to the F019 cleanup level o Pretreat/Treat o On-site RCRA Vault	o Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm. o Removal, pretreat/treat and on-site RCRA vault of F019 sludge contaminated with PCB to cleanup levels. o Pretreat/Treat o On-site RCRA Vault.	o Monitoring	3	3	5	3	3	5	78

* Impoundment includes the Norhtern and Southern Impoundments and the sludge pit.

0002148

TABLE 3.3

SUMMARY OF COST ESTIMATES OF REMEDIAL ACTION ALTERNATIVES
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

ALTERNATIVE NO.	DESCRIPTION	CAPITAL COST ($) (A)	ANNUAL O&M COSTS ($) (B)	PRESENT[a] WORTH OF O&M COSTS ($) (C)	TOTAL PRESENT WORTH ($) (A&C)
1	No action (fence, ~~monitor~~, deed restrict.)	91,000	67,000	1,044,718	1,135,718
2	Consolidate/cap impoundment, incinerate hot swamp, materials, slurry wall/cap swamp, flood berm, and monitor ground water	1,637,000	85,000	1,325,389	2,962,389
3	Off-site treat/landfill impoundment, incinerate hot swamp materials, off-site treat/landfill remaining Swamp F019 materials, ~~and monitor ground water~~	5,632,000	85,000	1,325,389	6,957,389
4	Off-site-treat/landfill impoundment, incinerate swamp materials~~, and monitor ground water~~	7,572,000	85,000	1,325,389	8,897,389
5	On-site treat/landfill impoundment, incinerate hot swamp materials, off-site treat/landfill remaining Swamp F019 materials, and monitor ground water	5,116,000	121,000	1,886,730	7,002,730
6	On-site treat/landfill impoundment, incinerate swamp materials, and monitor ground water	7,055,000	121,000	1,866,730	8,941,730
7	Consolidate/cap impoundment, incinerate swamp materials, and monitor ground water	6,109,000	79,000	1,231,832	7,340,832
8	Consolidate/cap impoundment, incinerate swamp materials, above PCB cleanup level, treat/landfill remaining Swamp F019 materials, and monitor ground water	4,848,000	79,000	1,231,832	6,079,832
9	On-site treat/landfill impoundment, incinerate hot swamp materials, on-site treat/landfill remaining Swamp F019 materials, monitor ground water	7,781,000	127,000	1,980,287	9,661,287

[a]Present Worth - Annual O&M Costs - Present Worth Factor
Present Worth Factor for a 31-year period based on 10 percent discount and 5 percent inflation rates = 15.593

TABLE 4.1

ALTERNATIVES FOR DETAILED ANALYSIS
FEASIBILITY STUDY
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

NO.	RESPONSE ACTION	IMPOUNDMENT[a]	SWAMP	GROUND WATER
1.	No Action	• Fencing • Deed restrictions	• Fencing • Deed restrictions	Monitoring
2.	Containment	• Consolidation • Cap	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Cap and slurry wall remaining PCB-contaminated F019 sludge	Monitoring
		Berm to be constructed to prevent flooding of NPL site [illegible]		
3.	Treatment	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • Off-site disposal	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Removal, pretreatment/treatment, and off-site disposal of remaining F019 sludge to cleanup levels	Monitoring
4.	Treatment	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • Off-site disposal	• Removal and incineration of all F019 sludge contaminated with PCB to cleanup	Monitoring

See footnote at end of table.

00002151

TABLE 4.1
(Continued)

NO.	RESPONSE ACTION	IMPOUNDMENT[a]	SWAMP	GROUND WATER
5.	Treatment	• Removal of all F019 sludge to the F019 cleanup levels • Pretreat/treat • On-site RCRA vault	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Removal, pretreatment/treatment, and off-site disposal of remaining F019 sludge to cleanup levels	Monitoring
6.	Treatment	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • On-site RCRA vault	• Removal and incineration of all F019 sludge contaminated with PCB to cleanup levels	Monitoring
9.	Combination No. 3	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • On-site RCRA vault	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Removal, pretreatment/treatment, and on-site disposal of F019 sludge contaminated with PCB to cleanup levels	Monitoring

[a]Impoundment includes the northern and southern impoundments and the sludge pit.

Note: Unless otherwise stated, cleanup levels refer to both PCB and F019 sludge cleanup levels.

TABLE 5.1

ALTERNATIVES FOR DETAILED ANALYSIS
FEASIBILITY STUDY
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

NO.	RESPONSE ACTION	IMPOUNDMENT[a]	SWAMP	GROUND WATER
1.	No Action	• Fencing • Deed restrictions	• Fencing • Deed restrictions	Monitoring
2.	Containment	• Consolidation • Cap	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Cap and slurry wall remaining PCB-contaminated F019 sludge	Monitoring
		Berm to be constructed to prevent flooding of NPL site		
3.	Treatment	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • Off-site disposal	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Removal, pretreatment/treatment, and off-site disposal of remaining F019 sludge to cleanup levels	Monitoring
4.	Treatment	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • Off-site disposal	• Removal and incineration of all F019 sludge contaminated with PCB to cleanup	Monitoring

See footnote at end of table.

TABLE 5.1
(Continued)

NO.	RESPONSE ACTION	IMPOUNDMENT[a]	SWAMP	GROUND WATER
5.	Treatment	• Removal of all F019 sludge to the F019 cleanup levels • Pretreat/treat • On-site RCRA vault	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Removal, pretreatment/treatment, and off-site disposal of remaining F019 sludge to cleanup levels	Monitoring
6.	Treatment	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • On-site RCRA vault	• Removal and incineration of all F019 sludge contaminated with PCB to cleanup levels	Monitoring
9.	Combination No. 3	• Removal of all F019 sludge to the F019 cleanup level • Pretreat/treat • On-site RCRA vault	• Removal and incineration of F019 sludge contaminated with PCB greater than 500 ppm • Removal, pretreatment/treatment, and on-site disposal of F019 sludge contaminated with PCB to cleanup levels	Monitoring

[a]Impoundment includes the northern and southern impoundments and the sludge pit.

Note: Unless otherwise stated, cleanup levels refer to both PCB and F019 sludge cleanup levels.

00002154

TABLE 5.2

SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
AND OTHER ADVISORIES OR GUIDELINES TO BE CONSIDERED
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	ALTERNATIVE 9
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND OTHER ADVISORIES OR GUIDELINES TO BE CONSIDERED (TBCs)	NO-ACTION (FENCING USE RESTRICTIONS, AND MONITORING)	CONSOLIDATE/CAP IMPOUNDMENT INCINERATE HOT SWAMP MATERIAL, SLURRY WALL/CAP SWAMP, FLOOD BERM, AND MONITOR GROUND WATER	OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT INCINERATE HOT SWAMP MATERIAL, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER (IF REQUIRED)	OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT INCINERATE F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER	ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP AND MONITOR GROUND WATER	ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER	ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, ON-SITE TREATMENT/LANDFILL REMAINING F019 SLUDGE IN SWAMP AND MONITOR GROUND WATER
CONTAMINANT SPECIFIC:							
Maximum Contaminant Level (MCL)	MCLs for chromium, cyanide fluoride and selenium are not achieved	MCLs for chromium, cyanide, fluoride and selenium are not achieved	MCLs for chromium, cyanide, fluoride, and selenium are not achieved	MCLs for chromium, cyanide, fluoride, and selenium are not achieved	MCLs for chromium, cyanide, fluoride, and selenium are not achieved	MCLs for chromium, cyanide, fluoride, and selenium are achieved in the treated ground water	MCLs for chromium, cyanide fluoride, and selenium are not achieved
15 USC 2601 Toxic Substance Control	Will not comply with 15 USC 2601	Compliance with 15 USC 2601 (Hot swamp material is incinerated)	Compliance with 15 USC 2601 (Hot swamp material is incinerated)	Compliance with 15 USC 2601 (Hot swamp material is incinerated)	Compliance with 15 USC 2601 (Hot swamp material is incinerated)	Compliance with 15 USC 2601 (Hot swamp material is incinerated)	Compliance with 15 USC 2601 (Hot swamp material is incinerated)
40CFR50 National Ambient Air Quality Standards (NAAQS)	-	Compliance with 40CFR50	Compliance with 40CFR50	Compliance with 40CFR50	Compliance with 40CFR50	Compliance with 40CFR50	Compliance with 40CFR50
Section 12 of the Clean Air Act (Public Health Bases to List Pollutants as Hazardous)	-	Compliance with Section 12 of the Clean Air Act	Compliance with Section 12 of the Clean Air Act	Compliance with Section 12 of the Clean Air Act	Compliance with Section 12 of the Clean Air Act	Compliance with Section 12 of the Clean Air Act	Compliance with Section 12 of the Clean Air Act
Ohio Revised Code (ORC) 6111.042 Regulations Requiring Compliance with National Effluent Standards	Will not comply with ORC 6111.042	Compliance with ORC 6111.042	Compliance with ORC 6111.042	Compliance with ORC 6111.042	Compliance with ORC 6111.042	Compliance with ORC 6111.042	Compliance with ORC 6111.042
Ohio Administrative Code (OAC) 3745-17-08(B) Restrictions of Fugitive Dust Emission	-	Compliance with OAC3745-17-08(B)	Compliance with OAC3745-17-08(B)	Compliance with OAC3745-17-08(B)	Compliance with OAC3745-17-08(B)	Compliance with OAC3745-17-08(B)	Compliance with OAC3745-17-08(B)
Health Advisories, U.S. EPA Office of Drinking Water	-	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration
Federal Ambient Water Quality Criteria (AWQC)	-	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration
Reference Doses (RfD) U.S. EPA Office of Research and Development	-	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration
Health Effects Assessments	-	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration
Carcinogenic Potency Factors, U.S. EPA Environmental Criteria and Assessment Office, U.S. EPA Carcinogen Assessment Group	-	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration

000021 55

TABLE 5.2
(Continued)

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	ALTERNATIVE 9
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND OTHER ADVISORIES OR GUIDELINES TO BE CONSIDERED (TBCs)	NO-ACTION	CONSOLIDATE/CAP IMPOUNDMENT INCINERATE HOT SWAMP MATERIAL, SLURRY WALL/CAP SWAMP, FLOOD BERM, AND MONITOR GROUND WATER	OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT. INCINERATE HOT SWAMP MATERIAL OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER	OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT INCINERATE F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER	ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP AND MONITOR GROUND WATER	ON-SITE TREATMENT/LANDFILL IMPOUNDMENT INCINERATE F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER	ON-SITE TREATMENT/LANDFILL IMPOUNDMENT INCINERATE HOT SWAMP MATERIAL, ON-SITE TREATMENT/LANDFILL REMAINING F019 SLUDGE IN SWAMP AND MONITOR GROUND GROUND WATER
LOCATION SPECIFIC:							
33CFR320-327 Harbors Act of 1899	-	Compliance with 33CFR320-327	Compliance with 33CFR320-327	Compliance with 33CFR320-327	Compliance with 33CFR320-327	Compliance with 33CFR320-327	Compliance with Rivers and 33CFR320-327
33CFR320-329 Regulations of Activities Affecting Waters of the U.S.	-	Compliance with 33CFR320-329	Compliance with 33CFR320-329	Compliance with 33CFR320-329	Compliance with 33CFR320-329	Compliance with 33CFR320-329	Compliance with 33CFR320-329
Executive Order 11988 Floodplains Management	Will not comply with Executive Order 11988	Compliance with Executive Order 11988	Compliance with Executive Order 11988	Compliance with Executive Order 11988	Compliance with Executive Order 11988	Compliance with Executive Order 11988	Compliance with Executive Order 11988
16 USC 1531 Endangered Species Act of 1978	-	Compliance with 16 USC 1531	Compliance with 16 USC 1531	Compliance with 16 USC 1531	Compliance with 16 USC 1531	Compliance with 16 USC 1531	Compliance with 16 USC 1531
U.S. EPA's Ground Water Protection Strategy	-	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration	TBC will be taken into consideration
16 USC 661 Fish and Wildlife Improvement Act	-	Compliance with 16 USC 661	Compliance with 16 USC 661	Compliance with 16 USC 661	Compliance with 16 USC 661	Compliance with 16 USC 661	Compliance with 16 USC 661
Section 404 of the Clean Water Act of 1977	-	Compliance with Section 404 of the Clean Water Act	Compliance with Section 404 of the Clean Water Act	Compliance with Section 404 of the Clean Water Act	Compliance with Section 404 of the Clean Water Act	Compliance with Section 404 of the Clean Water Act	Compliance with Section 404 of the Clean Water Act
Ohio Administrative Code (OAC) 3745-27-06 Solid Waste Disposal Facility Plan Approval	-	Compliance with OAC 3745-27-06	Compliance with OAC 3745-27-06	Compliance with OAC 3745-27-06	Compliance with OAC 3745-27-06	Compliance with OAC 3745-27-06	Compliance with OAC 3745-27-06
OAC 3745-54-18 Location Standards	Will not comply with OAC 3745-54-18	Will not comply with OAC 3745-54-18	Compliance with OAC 3745-54-18	Compliance with OAC 3745-54-18	Compliance with OAC 3745-54-18	Compliance with OAC 3745-54-18	Compliance with OAC 3745-54-18
Ohio Revised Code (ORC) 1502.06 Dams, Dikes, and Levees	-	Compliance with ORC 1502.06	Compliance with ORC 1502.06	Compliance with ORC 1502.06	Compliance with ORC 1502.06	Compliance with ORC 1502.06	Compliance with ORC 1502.06
House Bill No. 592	Will not comply with House Bill No. 592	Will not comply with House Bill No. 592	Compliance with House Bill No. 592	Compliance with House Bill No. 592	Will not comply with House Bill No. 592	Will not comply with House Bill No. 592	Will not comply with House Bill No. 592

00002156

TABLE 5.2
(Continued)

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND OTHER ADVISORIES OR GUIDELINES TO BE CONSIDERED (TBCs)	ALTERNATIVE 1 NO-ACTION (FENCING, USE RESTRICTIONS, AND MONITORING)	ALTERNATIVE 2 CONSOLIDATE/CAP IMPOUNDMENT INCINERATE HOT SWAMP MATERIAL, SLURRY WALL/CAP SWAMP, FLOOD BERM, AND MONITOR GROUND WATER	ALTERNATIVE 3 OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP, AND MONITOR GROUND	ALTERNATIVE 4 OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT, INCINERATE F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER	ALTERNATIVE 5 ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP AND MONITOR GROUND	ALTERNATIVE 6 ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER	ALTERNATIVE 9 ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, ON-SITE TREATMENT/LANDFILL REMAINING F019 SLUDGE MONITOR GROUND WATER
ACTION SPECIFIC:							
40CFR264.310 - Landfill Closure Requirements and Post-Closure Care	Will not comply with 40CFR264.310	Compliance with 40CFR264.310	Compliance with 40CFR264.310	Compliance with 40CFR264.310	Compliance with 40CFR264.310	Compliance with 40CFR264.310	Compliance with 40CFR264.310
40CFR264.92, 264.99 Ground Water Monitoring	Compliance with 40CFR264.92, 264.99	Compliance with 40CFR264.92, 264.99	Compliance with 40CFR264.92, 264.99	Compliance with 40CFR264.92, 264.99	Compliance with 40CFR264.92, 264.99	Compliance with 40CFR264.92 264.99	Compliance with 40CFR264.92, 264.99
29CFR1904, 1910, 1926 OSHA Requirements	Compliance with 29CFR1904, 1910, 1926	Compliance with 29CFR1904, 1910, 1926	Compliance with 29CFR1904, 1910, 1926	Compliance with 29CFR1904 1910, 1926	Compliance with 29CFR1904, 1910, 1926	Compliance with 29CFR1904, 1910, 1926	Compliance with 29CFR1904, 1910, 1926
49CFR107.1, 1711.500 DOT Regulations for Hazardous Materials Transport	-	Compliance with 49CFR107.1, 1711.500	Compliance with 49CFR107.1, 1711.500	Compliance with 49CFR107.1, 1711.500	Compliance with 49CFR107.1, 1711.500	Compliance with 49CFR107.1, 1711.500	Compliance with 49CFR107.1, 1711.500
49CFR170 - 189 DOT Regulations for Licensed Material Transport	-	Compliance with 49CFR170-189	Compliance with 49CFR170-189	Compliance with 49CFR170-189	Compliance with 49CFR170-189	Compliance with 49CFR170-189	Compliance with 49CFR170-189
40CFR264.116 and 264.117 Use Restrictions	Compliance with 40CFR264.116 and 264.117	Compliance with 40CFR264.116 and 264.117	Compliance with 40CFR264.116 and 264.117	Compliance with 40CFR264.116 and 264.117	Compliance with 40CFR264.116 and 264.117	Compliance with 40CFR264.116 and 264.117	Compliance with 40CFR264.116 and 264.117
40CFR268 Land Disposal Restrictions	-	Compliance with 40CFR268	Compliance with 40CFR268	Compliance with 40CFR268	Compliance with 40CFR268	Compliance with 40CFR268	Compliance with 40CFR268
40CFR264.228 Surface Impoundment Closure and Post-Closure Requirements	Will not comply with 40CFR264.228	Compliance with 40CFR264.228	Compliance with 40CFR264.228	Compliance with 40CFR228	Compliance with 40CFR228	Compliance with 40CFR228	Compliance with 40CFR228
Ohio Administrative Code (OAC) 3745-1-05(A) & (B) Antidegradation Policy	-	Compliance with OAC 3745-1-05 (A) & (B)	Compliance with OAC 3745-1-05 (A) & (B)	Compliance with OAC 3745-1-05 (A) & (B)	Compliance with OAC 3745-1-05 (A) & (B)	Compliance with OAC 3745-1-05 (A) & (B)	Compliance with OAC 3745-1-05 (A) & (B)
OAC 3745-31-05 (A) (3) Permit to Install	-	Compliance with OAC 3745-31-05 (A) (3)	Compliance with OAC 3745-31-05 (A) (3)	Compliance with OAC 3745-31-05 (A) (3)	Compliance with OAC 3745-31-05 (A) (3)	Compliance with OAC 3745-31-05 (A) (3)	Compliance with OAC 3745-31-05 (A) (3)
OAC 3745-17-11 Restriction of Particulate Emission from Industrial Processes	-	Compliance with OAC 3745-17-11	Compliance with OAC 3745-17-11	Compliance with OAC 3745-17-11	Compliance with OAC 3745-17-11	Compliance with OAC 3745-17-11	Compliance with OAC 3745-17-11
OAC 3745-57-01 Environmental Performance Standards	-	Compliance with OAC 3745-57-01	Compliance with OAC 3745-57-01	Compliance with OAC 3745-57-01	Compliance with OAC 3745-57-01	Compliance with OAC 3745-57-01	Compliance with OAC 3745-57-01

00002157

TABLE 5.2
(Continued)

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND OTHER ADVISORIES OR GUIDELINES TO BE CONSIDERED (TBCs)	ALTERNATIVE 1 NO-ACTION (FENCING, USE RESTRICTED AND MONITORING)	ALTERNATIVE 2 CONSOLIDATE/CAP IMPOUNDMENT INCINERATE HOT SWAMP MATERIAL, SLURRY WALL/CAP SWAMP, FLOOD BERM, AND MONITOR GROUND WATER	ALTERNATIVE 3 OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER	ALTERNATIVE 4 OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT, INCINERATE F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER	ALTERNATIVE 5 ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP AND MONITOR GROUND WATER	ALTERNATIVE 6 ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE F019 SLUDGE IN SWAMP, AND MONITOR GROUND WATER	ALTERNATIVE 6 ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIAL, ON-SITE TREATMENT/LANDFILL REMAINING F019 SLUDGE IN SWAMP AND MONITOR GROUND WATER
ACTION SPECIFIC (Continued):							
OAC 3745-66-11 Closure Performance Standards	Will not comply with OAC 3745-66-11	Compliance with OAC 3745-66-11	Compliance with OAC 3745-66-11	Compliance with OAC 3745-66-11	Compliance with OAC 3745-66-11	Compliance with OAC 3745-66-11	Compliance with OAC 3745-66-11
OAC 3745-66-14 Disposal of Decontamination of Equipment	-	Compliance with OAC 3745-66-14	Compliance with OAC 3745-66-14	Compliance with OAC 3745-66-14	Compliance with OAC 3745-66-14	Compliance with OAC 3745-66-14	Compliance with OAC 3745-66-14
OAC 3745-50-44 Contents of "Part B" Permit Application	-	Compliance with OAC 3745-50-44	Compliance with OAC 3745-50-44	Compliance with OAC 3745-50-44	Compliance with OAC 3745-50-44	Compliance with OAC 3745-50-44	Compliance with OAC 3745-50-44
OAC 3745-32 Generator Standards	-	Compliance with OAC 3745-32	Compliance with OAC 3745-32	Compliance with OAC 3745-32	Compliance with OAC 3745-32	Compliance with OAC 3745-32	Compliance with OAC 3745-32
OAC 3745-54-90 through 99 Ground Water Protection, Ground Water Standards, Point of Compliance, Monitoring Program	Monitoring Program will be established	Compliance with OAC 3745-54-90 through 99	Compliance with OAC 3745-54-90 through 99	Compliance with OAC 3745-54-90 through 99	Compliance with OAC 3745-54-90 through 99	Compliance with OAC 3745-54-90 through 99	Compliance with OAC 3745-54-90 through 99
OAC 3745-31-02 Requirements	-	Compliance with OAC 3745-31-02	Compliance with OAC 3745-31-02	Compliance with OAC 3745-31-02	Compliance with OAC 3745-31-02	Compliance with OAC 3745-31-02	Compliance with OAC 3745-31-02
OAC 3745-31-04 Restrictions	Compliance with OAC 3745-31-04	Compliance with OAC 3745-31-04	Compliance with OAC 3745-31-04	Compliance with OAC 3745-31-04	Compliance with OAC 3745-31-04	Compliance with OAC 3745-31-04	Compliance with OAC 3745-31-04
OAC 3745-31-05 Criteria for Decision by the Director	-	Compliance with OAC 3745-31-05	Compliance with OAC 3745-31-05	Compliance with OAC 3745-31-05	Compliance with OAC 3745-31-05	Compliance with OAC 3745-31-05	Compliance with OAC 3745-31-05
OAC 3745-32-02 Section 401 Water Quality Certification Required	-	Compliance with OAC 3745-32-02	Compliance with OAC 3745-32-02	Compliance with OAC 3745-32-02	Compliance with OAC 3745-32-02	Compliance with OAC 3745-32-02	Compliance with OAC 3745-32-02
OAC 3745-32-05 Criteria for Decision by Director	-	Compliance with OAC 3745-32-05	Compliance with OAC 3745-32-05	Compliance with OAC 3745-32-05	Compliance with OAC 3745-32-05	Compliance with OAC 3745-32-05	Compliance with OAC 3745-32-05
OAC 3734.05 (c) (6) Licensing Requirements	-	Compliance with OAC 3734.05 (c) (6)	Compliance with OAC 3734.05 (c) (6)	Compliance with OAC 3734.05 (c) (6)	Compliance with OAC 3734.05 (c) (6)	Compliance with OAC 3734.05 (c) (6)	Compliance with OAC 3734.05 (c) (6)
ORC 6111.04 Acts of Pollution Prohibited	-	Compliance with ORC 6111.04	Compliance with ORC 6111.04	Compliance with ORC 6111.04	Compliance with ORC 6111.04	Compliance with ORC 6111.04	Compliance with ORC 6111.04
ORC 6111.45 Ohio EPA Approved of Plans for Disposal of Waste	-	Compliance with ORC 6111.45	Compliance with ORC 6111.45	Compliance with ORC 6111.45	Compliance with ORC 6111.45	Compliance with ORC 6111.45	Compliance with ORC 6111.45
ORC 3767 Nuisances	-	Compliance with ORC 3767	Compliance with ORC 3767	Compliance with ORC 3767	Compliance with ORC 3767	Compliance with ORC 3767	Compliance with ORC 3767
Threshold Limit Values, American Conference of Government Industrial Hygienists	-	Compliance with Threshold Limit Values during remediation	Compliance with Threshold Limit Values during remediation	Compliance with Threshold Limit Values during remediation	Compliance with Threshold Limit Values during remediation	Compliance with Threshold Limit Values during remediation	Compliance with Threshold Limit Values during remediation

00002158

FIGURES

00002159

DRAWING NUMBER 303029-A12		CHECKED BY / APPROVED BY	GSJ 4.28.87	DRAWN BY	IA

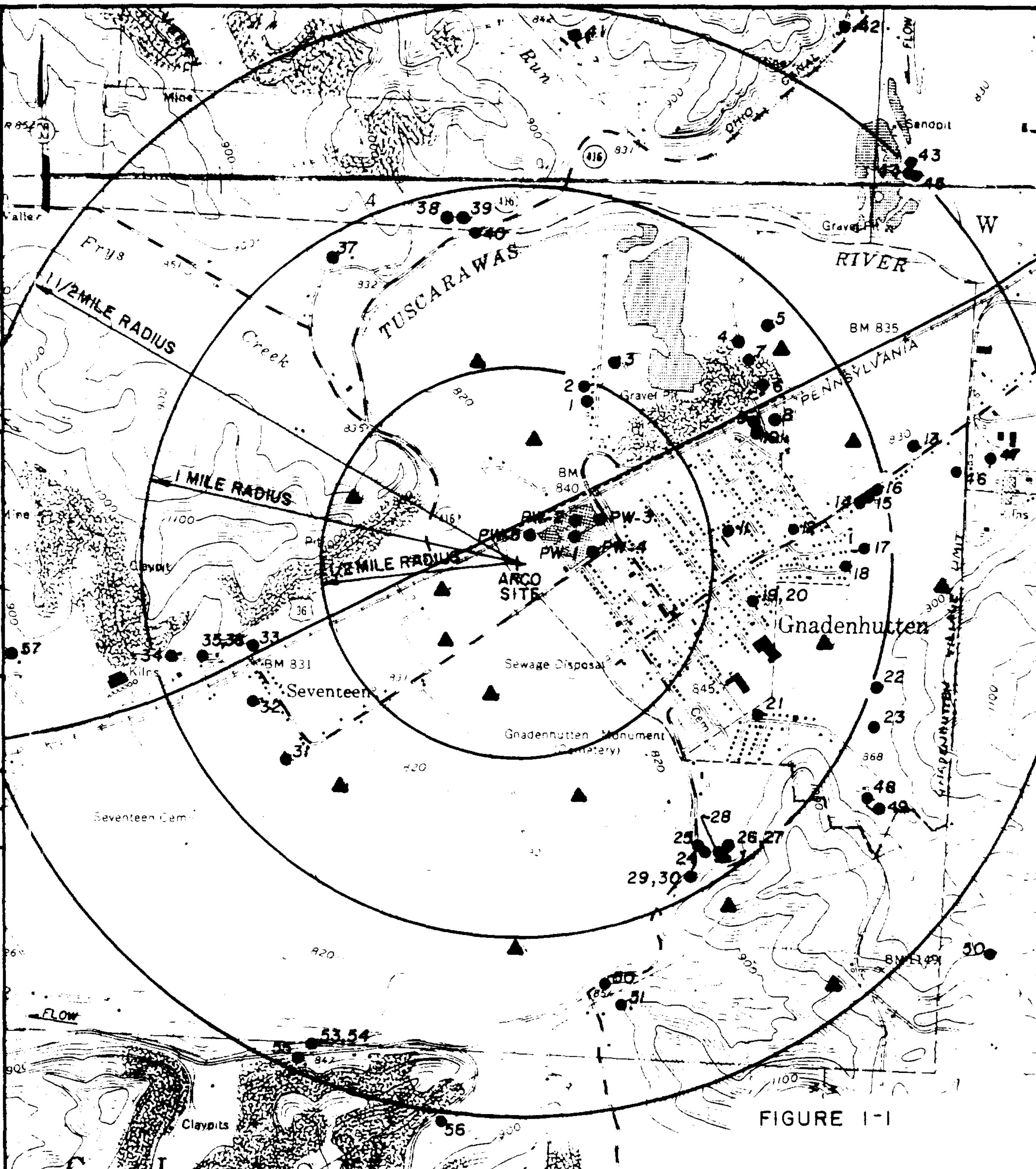

FIGURE 1-1

REGIONAL MAP SHOWING WATER AND OIL/GAS WELL LOCATIONS
GNADENHUTTEN, OHIO

PREPARED FOR

ATLANTIC RICHFIELD COMPANY
LOS ANGELES, CALIFORNIA

SCALE
0 2000 4000 FEET

LEGEND
10● WATER WELL (LOG IN APPENDIX C)
▲ OIL / GAS WELL

REFERENCES:
1. U.S.G.S. 7.5-MINUTE SERIES GNADENHUTTEN AND NEW PHILADELPHIA, OHIO QUADRANGLES DATED 1962, SCALE: 1"=2000'
2. ODNR DIVISION OF WATER, 1945-1985 WELL LOGS AND DRILLING REPORTS
3. BURGESS & NIPLE LTD., 1984 HYDROGEOLOGIC STUDY, ARCO METALS CO. GNADENHUTTEN, OHIO.

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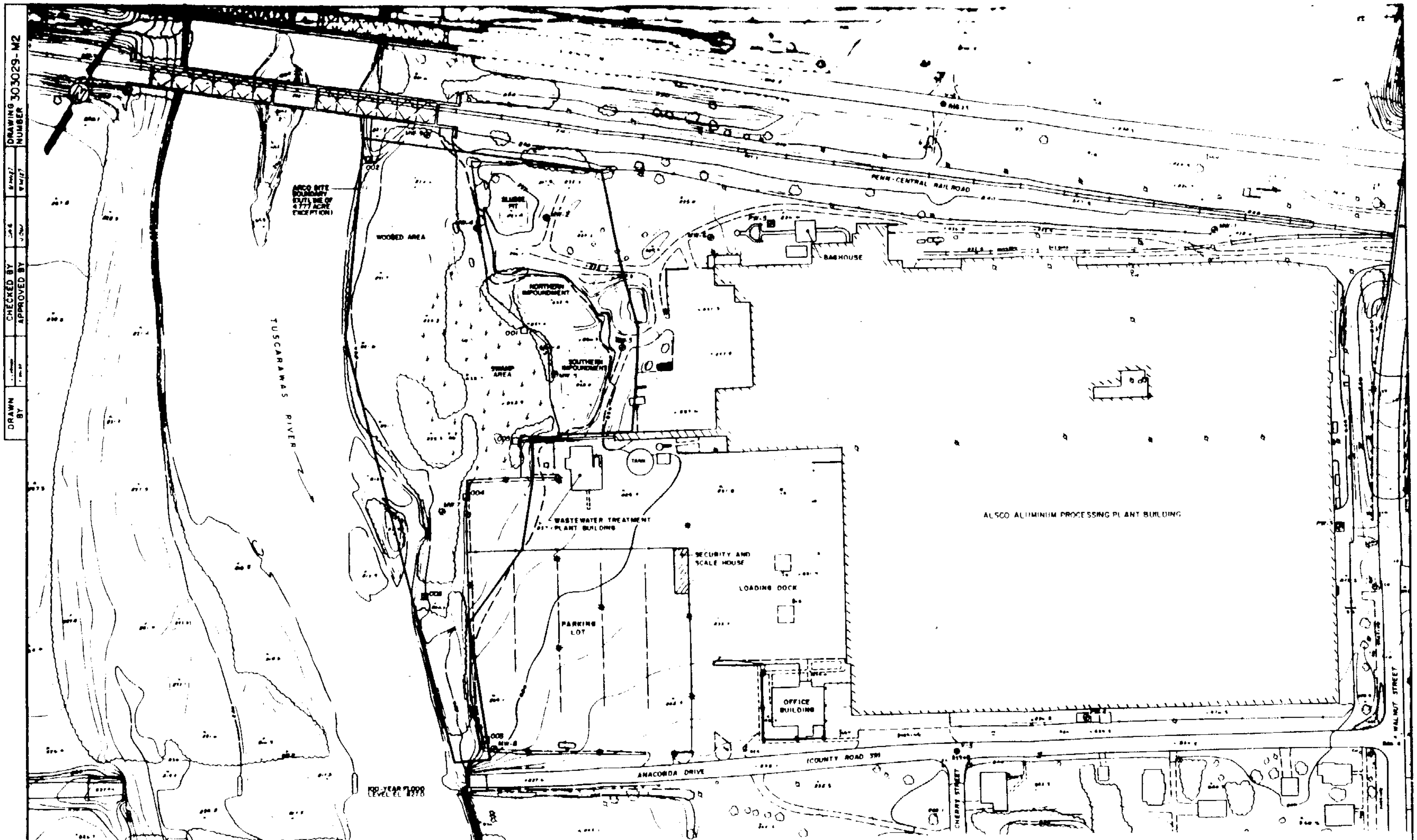
65360

Do Not Scale This Drawing

00002160



LEGEND:
MW-4 GROUND WATER MONITORING WELL LOCATION
006 PERMITTED PLANT OUTFALL LOCATION
001 FORMER OUTFALL LOCATION

SCALE
0 FEET

REFERENCES

FIGURE 1-2
ALSCO-ANACONDA NPL
SITE VICINITY
GNADENHUTTEN, OHIO

PREPARED FOR

ATLANTIC RICHFIELD COMPANY
LOS ANGLES, CALIFORNIA

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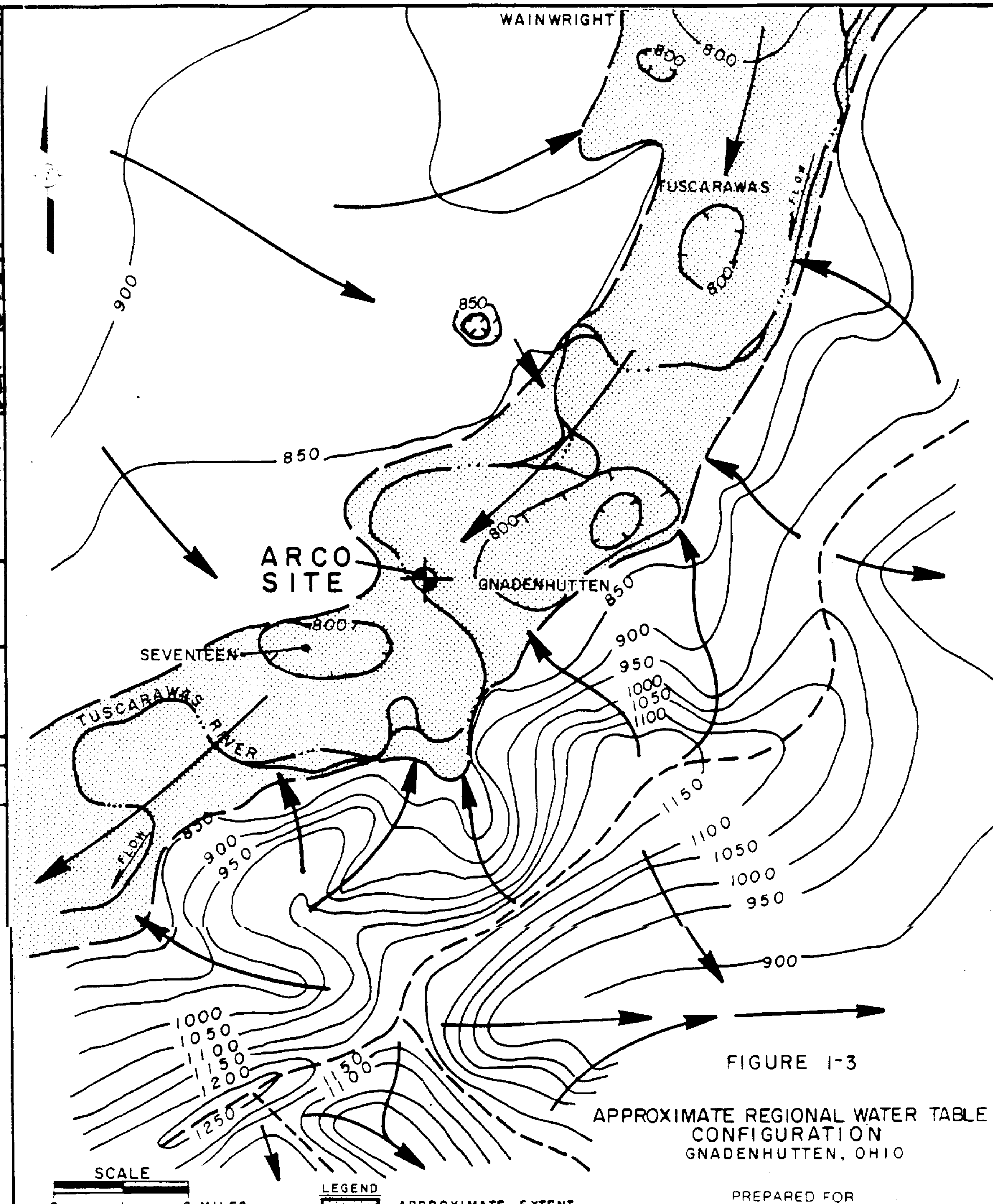

FIGURE 1-3

APPROXIMATE REGIONAL WATER TABLE CONFIGURATION
GNADENHUTTEN, OHIO

REFERENCE:
OHIO DEPARTMENT OF NATURAL RESOURCES, UNDATED, TUSCARAWAS COUNTY WATER WELL INVENTORY DATA.

LEGEND

APPROXIMATE EXTENT OF BURIED VALLEY

1000 APPROXIMATE WATER TABLE POTENTIOMETRIC CONTOUR; ELEVATION IN FEET ABOVE MEAN SEA LEVEL

APPROXIMATE GROUND WATER DIVIDE

APPROXIMATE GROUND WATER FLOW LINE

PREPARED FOR

ATLANTIC RICHFIELD COMPANY
LOS ANGLES, CALIFORNIA

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DRAWING NUMBER 303029-A11

DRAWN BY J. LOGRECO 3-6-87

CHECKED BY

APPROVED BY

2A 2A

65360

Do Not Scale This Drawing

ERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	APPLICABILITY
WAMP MATERIAL	No Action	None			NCP require no action to be carried through detailed analysis of alternatives.
	Access Restrictions	Fencing		Fencing of the site to restrict access.	Potentially viable.
		Deed Restriction		All deeds for property within potentially contaminated areas to include restrictions on use of property.	Potentially viable.
	Surface Stabilization	Dust Control	Capping	A process used to cover buried wastes to prevent infiltration.	Not appropriate by itself, may be used as a support technology
			Cofferdam	Cofferdams constructed around a contaminated area to isolate that area from stream flow.	Not appropriate by itself, may be used as a support technology
		Sediment Control Barrier	Curtain Barrier	Barriers more durable and effective than cofferdams.	Not appropriate by itself, may be used as a support technology
			Revegetation	Vegetation cover used to stabilize intermediate cover surface.	Not appropriate by itself, may be used as a support technology
	Containment	Horizontal Barriers	Block Displacement	Controlled injection of slurry in notched injection holes to produce horizontal barrier beneath the contaminants.	Difficult to determine integrity of barrier.
			Grout Injection	Pressure injection of grout at depth through closely spaced drilled holes.	Difficult to determine integrity of barrier.
		Vertical Barriers	Soil-Bentonite Slurry Wall	Trench excavated while filled with a bentonite water slurry. Trench is backfilled with a soil-bentonite mix.	Potentially viable.
			Cement-Bentonite Slurry Wall	Trench excavated while filled with a cement-bentonite water slurry. Cement sets up and forms the wall.	Potentially viable.
			Grout Curtain	Pressure injection of grout in a regular overlapping pattern of drilled holes.	Difficult to determine integrity of barrier.
			Sheet Piling	Driven steel sheet piling.	Interlocks may be difficult to seal.
			Vibrating Beam Wall	Vibrating force used to advance a steel beam into the ground and injection of a relatively thin wall of cement or bentonite as beam is withdrawn.	Difficult to assure continuity of barrier, leakage may occur.
		Capping	Clay	Compacted clay.	Not appropriate by itself, may be used as a support technology.
			Asphalt	Spray application of a layer of asphalt or asphaltic concrete.	Not appropriate by itself, may be used as a support technology.
			Concrete	Concrete slab.	Not appropriate by itself, may be used as a support technology.
			Gravel-Clay	Compacted clay covered with gravel to provide erosion and moisture control.	Not appropriate by itself, may be used as a support technology.
			Soil-Clay	Compacted clay covered with soil to provide erosion and moisture control.	Not appropriate by itself, may be used as a support technology.
			Soil-Synthetic Liner	Impermeable synthetic membrane covered with soil to provide protection of the liner.	Not appropriate by itself, may be used as a support technology.

FIGURE 2-3

IDENTIFICATION OF APPLICABLE TECHNOLOGIES AND PROCRESS OPTIONS FOR THE [redacted] UNIT
ALSCO ANACONDA WELL SITE, GNADENHUTTEN, OHIO

000C2162

OPERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	APPLICABILITY
SWAMP MATERIAL (continued)	Containment (continued)		Soil-Synthetic Liner, Clay	Compacted clay covered with a synthetic membrane followed by a drainage/filter layer and top soil to provide erosion and moisture control.	Potentially viable.
		Surface Water Control	Diversion/Collection	Dikes and berms, channels, terrace and benches, chutes, seepage basins and diches.	Not appropriate by itself, may be used as a support technology.
			Grading	Technique to reshape the land surface to manage surface water infiltration, run off and to control erosion.	Not appropriate by itself, may be used as a support technology.
			Soil Stabilization	Cement, quicklime, or other grouting materials mixed to create a seal to minimize infiltration and to control erosion.	Not appropriate by itself, may be used as a support technology.
	Removal	Mechanical Transportation		Complete or partial removal involving excavation of contaminated materials for on-site or off-site disposal.	Not appropriate by itself, may be used as a support technology.
	Offsite Landfill			Disposal of wastes in an off-site RCRA landfill.	Potentially viable.
	Onsite Landfill			Disposal of wastes in an on-site RCRA type landfill.	Potentially viable.
	On-Site Control/ Treatment	Biological Treatment	In-situ Biodegradation	Soil introduced with oxygen and nutrients to enhance biological degradation of organics.	Volumes too small for consideration.
			On-Site Landfarming	Soil spread over land for biological degradation with microorganisms in aerated and nutrient rich soils.	Volumes too small for consideration.
		Solidification/ Stabilization	Cement-Based	Slurry of wastes and water mixed with Portland cement to form a solid.	Not appropriate for PCB.
			Thermoplastics	Dried waste heated and dispensed through a heated plastic matric of asphalt, bitumen, paraffin, or polyethylene to form a solid.	Not appropriate for PCB.
			Organic Polymer	Waste mixed with a polymer/catalyst (urea-fomaldehyde or vinyl esterstyrene polymers) to form a solid.	Not appropriate for PCB.
			Glassification	Waste mixed with molten glass to form a solid.	Not appropriate for PCB.
			Lime-Based	Waste reacted with lime and fine-grained siliceous material (fly ash, ground blast furnace slag, cement kiln dust) to form a solid.	Not appropriate for PCB, but potentially viable for Ford sludge contaminated with less than 500 mg/kg PCB.
		Physical/Chemical Treatment	Fluidized Bed Combustor	Waste in a fine granular state fluidized by a blowing gas for incineration.	Volumes too small for onsite incineration.
			Infrared Incinerator	An incinerator using silicon carbide resistance heating elements to provide infrared energy for incineration.	Volumes too small for onsite incineration.
			Rotary Kiln Incinerator	An incinerator using rotating refractory kiln.	Volumes too small for onsite incineration.
			Pyrolitic Incinerator	Incinerator using heat in the absence of air to thermally degrade volatile gaseous portion. Residual solid is comprised of fixed carbon and ash.	Volumes too small for onsite incineration.
			Fluidized Bed Incinerator	An incinerator with turbulant bed of inert granular material (sand) to improve the transfer of heat to waste streams.	Volumes too small for onsite incineration.

FIGURE 2-1 (Continued)

SHEET 2 OF 3

C0002163

OPERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	APPLICABILITY
SWAMP MATERIAL* (continued)		Physical/Chemical Treatment (continued)	Cement or Lime Kiln Incinerator	Cement kiln to incinerate the wastes by combustion.	Volumes too small for onsite incineration.
			Multiple Hearth Incinerator	Waste fed to the furnace roof of incinerator to combust successively through a series of flat hearths.	Volumes too small for onsite incineration.
			Molten Salt Incinerator	Injection of wastes beneath a bed of molten sodium carbonate for incineration.	Volumes too small for onsite incineration.
			High-Temperature Fluid Wall Incinerator	A patented reactor at a very high temperature (about 4000 F) to reduce organic wastes to their elemental state.	Volumes too small for onsite incineration.
			Plasma Arc Incinerator	Energy in ionized gas molecules generated by plasma arc pyrolysis process to cause dissociation of organics.	Volumes too small for onsite incineration.
			Circulating Bed Incinerator	Conventional fluidized beds at higher velocities and with finer sorbents than fluidized bed systems for incineration.	Volumes too small for onsite incineration.
			Industrial Boiler/Furnace	Wastes used as supplementary fuel to coal, oil or natural gas in fire tube and water tube of industrial boilers.	Volumes too small for onsite incineration.
			Microwave Plasma Incinerator	Catalyzed microwave process using short duration, high energy pulses of microwave energy to activate oxygen and organic molecules at a metal surface.	Volumes too small for onsite incineration.
			Thermal Desorption	A process used to thermally desorb volatile organic compounds (VOC) from soil by increasing temperature.	Not appropriate for PCB.
			Soil Aeration	Aeration of soil via injection wells used to promote microbial biodegradation and to strip volatile organics from soil.	Not appropriate for PCB.
			Soil Washing	Water or steam used to wash or volatilize and flush organics from soil.	Not appropriate for PCB.
			Injection/Grouting (in-situ)	Pressure injection of grout at depth through closely spaced drilled holes to solidify contaminants.	Not appropriate for PCB.
			Vitrification	High current of electricity passed through a media for gradual melting of the media to volatilize organics and inorganics for collection at the ground surface.	Not appropriate.
			Solvent Extraction	Solvent introduced into a contactor where it mixes with soil and elutriate is collected and later treated.	Not appropriate for PCB.
	Off-Site Treatment	Thermal Destruction	Incineration	Permitted RCRA facilities used to incinerate soils.	Potentially viable.
		Biological Treatment	Landfarming	Soils spread over land in licensed landfarm. Biological degradation with microorganisms in aerated and nutrient-rich soils.	Not available commercially for PCB contaminated soils.

*Include sludges and associated contaminated soils.

LEGEND

[ ] Not applicable for technology screening.

FIGURE 2-1 (Continued)

SHEET 3 OF 3

00002164

OPERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	APPLICABILITY
IMPOUNDMENT	No Action	None			NCP requires no action to be carried through detailed analysis of alternatives.
	Access Restrictions	Fencing		Fencing of the site to restrict access.	Potentially viable.
		Deed Restriction		All deeds for property within potentially contaminated areas to include restrictions on use of property.	Potentially viable.
	Surface Stabilization	Dust Control	Capping	A process used to cover buried wastes to prevent infiltration.	Not appropriate by itself, may be used as a support technology
			Cofferdam	Cofferdams constructed around a contaminated area to isolate that area from stream flow.	Not appropriate by itself, may be used as a support technology
		Sediment Control Barrier	Curtain Barrier	Barriers more durable and effective than cofferdams.	Not appropriate by itself, may be used as a support technology
			Revegetation	Vegetation cover used to stabilize intermediate cover surface.	Not appropriate by itself, may be used as a support technology
	Containment	Horizontal Barriers	Block Displacement	Controlled injection of slurry in notched injection holes to produce horizontal barrier beneath the contaminants.	Difficult to determine integrity of barrier.
			Grout Injection	Pressure injection of grout at depth through closely spaced drilled holes.	Difficult to determine integrity of barrier.
		Vertical Barriers	Soil-Bentonite Slurry Wall	Trench excavated while filled with a bentonite water slurry. Trench is backfilled with a soil-bentonite mix.	Potentially viable.
			Cement-Bentonite Slurry Wall	Trench excavated while filled with a cement-bentonite water slurry. Cement sets up and forms the wall.	Potentially viable.
			Grout Curtain	Pressure injection of grout in a regular overlapping pattern of drilled holes.	Difficult to determine integrity of barrier.
			Sheet Piling	Driven steel sheet piling.	Interlocks may be difficult to seal.
			Vibrating Beam Wall	Vibrating force used to advance a steel beam into the ground and injection of cement or bentonite as beam is withdrawn.	Difficult to assure continuity of barrier, leakage may occur.
		Capping	Clay	Compacted clay.	Not appropriate by itself, may be used as a support technology.
			Asphalt	Spray application of a layer of asphalt or asphaltic concrete.	Not appropriate by itself, may be used as a support technology.
			Concrete	Concrete slab.	Not appropriate by itself, may be used as a support technology.
			Gravel-Clay	Compacted clay covered with gravel to provide erosion and moisture control.	Not appropriate by itself, may be used as a support technology.
			Soil-Clay	Compacted clay converted with soil to provide erosion and moisture control.	Not appropriate by itself, may be used as a support technology.
			Soil-Synthetic Liner	Impermeable synthetic membrane covered with soil to provide protection of the liner.	Not appropriate by itself, may be used as a support technology.

FIGURE 2-2
IDENTIFICATION OF APPLICABLE TECHNOLOGIES AND PROCESS OPTIONS FOR THE ~~SWAMP~~ OPERABLE UNIT
ALSCO ANACONDA NPL SITE, GNADENHUTTON, OHIO

00002165

OPERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	APPLICABILITY
IMPOUNDMENT (continued)	Containment (continued)		Soil-Synthetic Liner, Clay	Compacted clay covered with a synthetic membrane followed by a drainage/filter layer and top soil to provide erosion and moisture control.	Potentially viable.
		Surface Water Control	Diversion/Collection	Dikes and berms, channels, terrace and benches, chutes, seepage basins and diches.	Not appropriate by itself, may be used as a support technology.
			Grading	Techniques to reshape the land surface to manage surface water infiltration, run off and to control erosion.	Not appropriate by itself, may be used as a support technology.
			Soil Stabilization	Cement, quicklime, or other grouting materials mixed to create a seal to minimize infiltration and to control erosion.	Not appropriate by itself, may be used as a support technology.
	Removal	Mechanical Transportation		Complete or partial removal involving excavation of materials for on-site or off-site disposal.	Not appropriate by itself, may be used as a support technology.
	Offsite Landfill			Disposal of wastes in an on-site RCRA type landfill.	Potentially viable.
	Onsite Landfill			Disposal of wastes in an off-site RCRA landfill.	Potentially viable.
		Biological Treatment	In-situ Biodegradation	Soil introduced with oxygen and nutrients to enhance biological degradation of organics.	Organic contamination is too low to consider biodegradation.
			On-Site Landfarming	Soil spread over land for biological degradation with microorganisms in aerated and nutrient rich soils.	Organic contamination is too low to consider biodegradation.
		Solidification/ Stabilization	Cement-Based	Slurry of wastes and water mixed with Portland cement to form a solid.	Heavy metals may not be stabilized
			Thermoplastics	Dried waste heated and dispensed through a heated plastic matric of asphalt, bitumen, paraffin, or polyethylene to form a solid.	Not appropriate.
			Organic Polymer	Waste mixed with a polymer/catalyst (urea-fomaldehyde or vinyl esterstyrene polymers) to form a solid.	No appropriate.
			Glassification	Waste mixed with molten glass to form a solid.	Not appropriate.
			Lime-Based	Waste reacted with lime and fine-grained siliceous material (fly ash, ground blast furnace slag, cement kiln dust) to form a solid.	Potentially viable.
	On-Site Control/ Treatment	Physical/Chemical Treatment	Fluidized Bed Combustor	Waste in a fine granular state fluidized by a blowing gas for incineration.	Not applicable for metal contamination.
			Infrared Incinerator	An incinerator using silicon carbide resistance heating elements to provide infrared energy for incineration.	Not applicable for metal contamination.
			Rotary Kiln Incinerator	An incinerator using rotating refractory kiln.	Not applicable for metal contamination.
			Pyrolitic Incinerator	Incinerator using heat in the absence of air to thermally degrade volatile gaseous portion. Residual solid is comprised of fixed carbon and ash.	Not applicable for metal contamination.
			Fluidized Bed Incinerator	An incinerator with turbulant bed of inert granular material (sand) to improve the transfer of heat to waste streams.	

FIGURE 2-2
(Continued)
SHEET 2 OF 3

0000002166

OPERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	APPLICABILITY
					Not applicable for metal contamination.
IMPOUNDMENT* (continued)		Physical/Chemical Treatment (continued)	Cement or Lime Kiln Incinerator	Cement kiln to incinerate the wastes by combustion.	Not applicable for metal contamination.
			Multiple Hearth Incinerator	Wastes fed to the furnace roof of incinerator to combust successively through a series of flat hearths.	Not applicable for metal contamination.
			Molten Salt Incinerator	Injection of wastes beneath a bed of molten sodium carbonate for incineration.	Not applicable for metal contamination.
			High-Temperature Fluid Wall Incinerator	A patented reactor at a very high temperature (about 4000 F) to reduce organic wastes to their elemental state.	Not applicable for metal contamination.
			Plasma Arc Incinerator	Energy in ionized gas molecules generated by plasma arc pyrolysis process to cause dissociation of organics.	Not applicable for metal contamination.
			Circulating Bed Incinerator	Conventional fluidized beds at higher velocities and with finer sorbents than fluidized bed systems for incineration.	Not applicable for metal contamination.
			Industrial Boiler/Furnace	Wastes used as supplementary fuel to coal, oil or natural gas in fire tube and water tube of industrial boilers.	Not applicable for metal contamination.
			Microwave Plasma Incinerator	Catalyzed microwave process using short duration, high energy pulses of microwave energy to activate oxygen and organic molecules at a metal surface.	Not applicable for metal contamination.
			Thermal Desorption	A process used to thermally desorb volatile organic compounds (VOC) from soil by increasing temperature.	Not applicable for metal contamination.
			Soil Aeration	Aeration of soil via injection wells used to promote microbial biodegradation and to strip volatile organics from soil.	Not applicable for metal contamination.
			Soil Washing	Water or steam used to wash or volatilize and flush organics from soil.	Not applicable, shallow water table.
			Injection/Grouting (in-situ)	Pressure injection of grout at depth through closely spaced drilled holes to solidify contaminants.	Difficult to determine integrity of barrier.
			Vitrification	High current of electricity passed through a media for gradual melting of the media to volatilize organics and inorganics for collection at the ground surface.	Not appropriate.
			Solvent Extraction	Solvent introduced into a contactor where it mixes with soil and elutriate is collected and later treated.	Not appropriate.
	Off-Site Treatment	Thermal Destruction	Incineration	Permitted RCRA facilities used to incinerate soils.	Not appropriate for metal contamination.
		Biological Treatment	Landfarming	Soils spread over land in licensed landfarm. Biological degradation with microorganisms in aerated and nutrient-rich soils.	Not applicable.

*Include sludges and associated contaminated soils.

LEGEND

[ ] Not applicable for technology screening.

FIGURE 2-2 (Continued)

SHEET 3 OF 3

00002167

OPERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	SCREENING CRITERIA: EFFECTIVENESS AND IMPLEMENTABILITY	SCREENING CRITERIA: RELATIVE COST
IMPOUNDMENT	No Action	None			
	Access Restrictions	Fencing		Effectiveness dependent on maintenance and implementation into the future. Commonly available technology.	Low capital, and maintenance costs.
		Deed Restriction		Effectiveness dependent on maintenance and implementation into the future. Commonly available technology.	Low capital, and maintenance costs.
	Containment	Vertical Barriers	Soil-Bentonite Slurry Wall	More effective than other containment barriers and provides lower permeability and higher capatibility. Can be constructed using available sources and known engineering practices.	Low to moderate capital and maintenance costs.
			Cement-Bentonite Slurry Wall	Less effective than soil-bentonite walls, typically more permeable and resistant to fewer chemicals. Can be constructed using available sources and known engineering practices.	Low to moderate capital and maintence costs. (more capital cost than soil-bentonite slurry well)
		Capping	Soil-Synthetic Liner Clay	Reliable and effective given proper maintenance. Can be constructed using available sources and known engineering practices.	Low to moderate capital cost.
	Offsite Landfill			Reliable and effective technology for containment of the source of contamination. Can be constructed using abailable sources and known engineering practices.	High capital costs.
	On-site Disposal	Landfill		Reliable and effective technology for containment of the source of contamination. Can be constructed using abailable sources and known engineering practices.	High capital costs, and moderate operation, and maintenance costs.
	On-Site Control Treatment	Solidification/ Stabilization	Lime-Based	Effective in containing metals. Can be implemented using properitory formulations and technology.	Low to moderate capital cost.

*Include sludges and associated contaminated soils.

LEGEND

[ ] Not carried forward for alternative development.

FIGURE 2-3
SCREENING OF APPLICABLE REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR THE IMPOUNDMENT OPERABLE UNIT
ALSCO-ANACONDA NPL SITE, GNADENHUTTON, OHIO

00002168

00002169

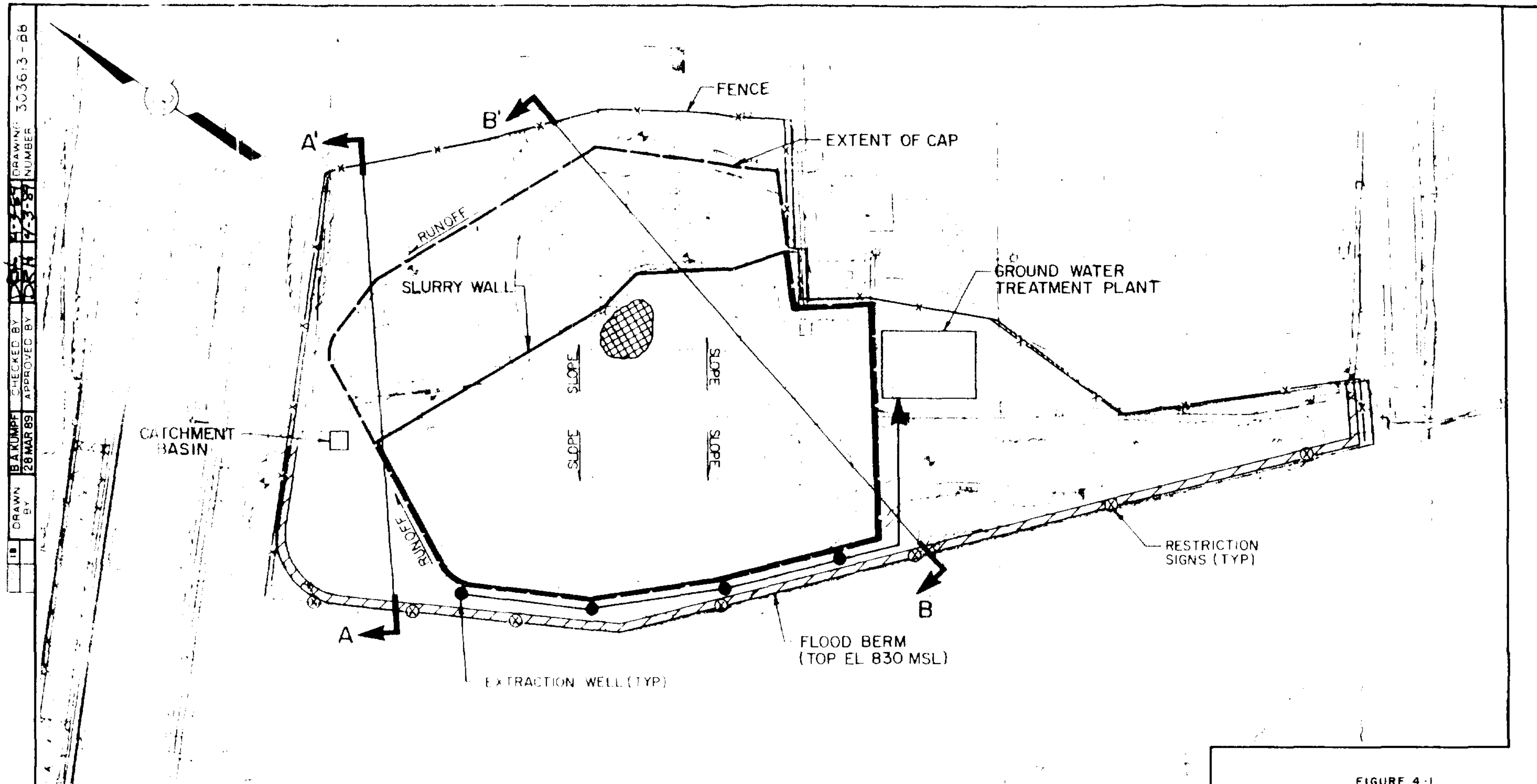
OPERABLE UNIT	GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	SCREENING CRITERIA: EFFECTIVENESS AND IMPLEMENTABILITY	SCREENING CRITERIA: RELATIVE COST
SWAMP MATERIAL*	No Action	None			
	Access Restrictions	Fencing		Effectiveness dependent on maintenance and implementation into the future. Commonly available technology.	Low capital and maintenance costs.
		Deed Restriction		Effectiveness dependent on maintenance and implementation into the future. Commonly available technology.	Low capital.
	Containment	Vertical Barriers	Soil-Bentonite Slurry Wall	More effective than other containment barriers and provides lower permeability and higher compatibility. Can be implemented using known engineering practices.	Low to moderate capital and maintenance costs.
			Cement-Bentonite Slurry Wall	Less effective than soil-bentonite walls, typically more permeable and resistant to fewer chemicals.	Low to moderate capital and maintence costs. (more capital cost than soil-bentonite slurry wall)
		Capping	Soil-Synthetic Liner, Clay	Reliable and effective provided given proper maintenance. Can be constructed using available resources and technology.	Low to moderate capital cost.
	Disposal	Offsite Landfill		Reliable and effective for portion of waste material with PCB concentrations less than 500 ppm given proper operation and maintenance in a RCRA type landfill. Can be constructed using available resources and engineering.	High capital costs.
		Onsite Landfill		Reliable and effective for portion of waste material with PCB concentrations less than 500 ppm given proper operation and maintenance in a RCRA type landfill. Can be constructed using available resources and engineering.	High capital practices costs.
	Off-Site Treatment	Thermal Destruction	Incineration	Most effective technology if implemented at incinerator permitted for PCB incineration.	High capital cost.

*Include sludges and associated contaminated soils.

LEGEND

[ ] Not carried forward for alternative development.

FIGURE 2-4
SCREENING OF APPLICABLE REMEDIAL AND PROCESS OPTIONS FOR THE SWAMP OPERABLE UNIT
ALSCO-ANACONDA NPL SITE, GNADENHUTTON, OHIO



SCALE
0 80 160 FEET

MATERIAL TO BE INCINERATED

NOTES:
1 FOR SECTION A-A' SEE DRAWING NO 303613-B20, FIGURE 2A
2 FOR SECTION B-B' SEE DRAWING NO 303613-B21, FIGURE 2B

FIGURE 4-1

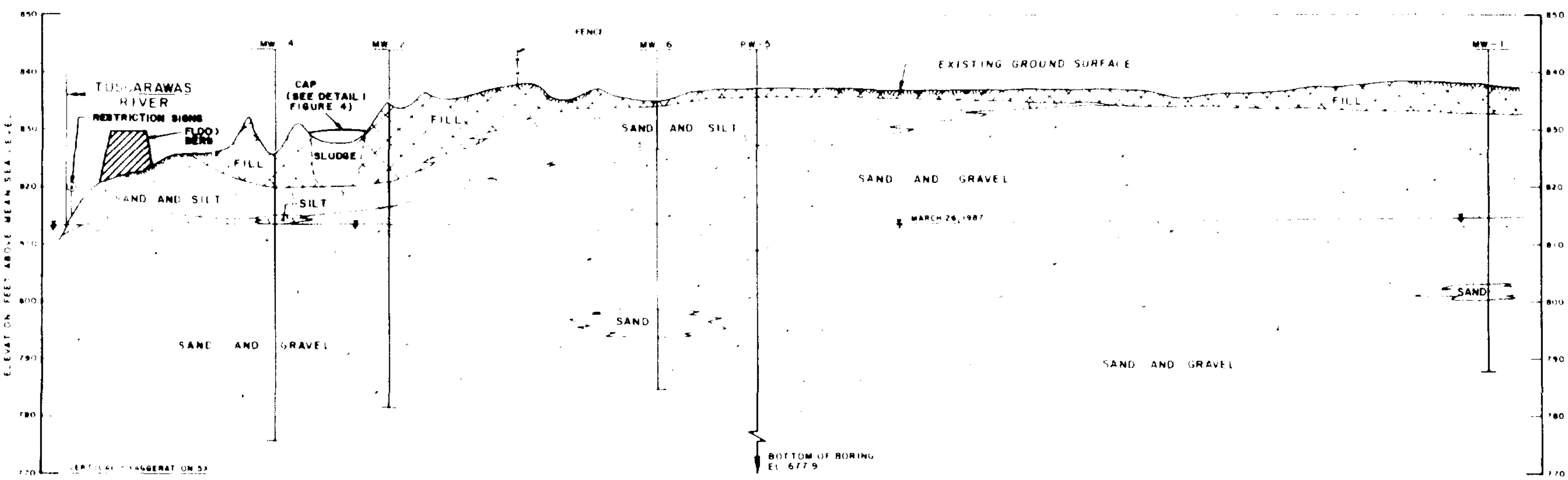
PLAN
ALTERNATIVE 2
CONSOLIDATE / CAP IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, SLURRY WALL / CAP SWAMP FLOOD BERM AND TREAT GROUND WATER

PREPARED FOR

ATLANTIC RICHFIELD COMPANY
LOS ANGELES, CALIFORNIA

INTERNATIONAL TECHNOLOGY CORPORATION

00062170



SECTION A-A'

(LOOKING NORTH NORTHWEST)

VERTICAL SCALE 0 20 FEET

HORIZONTAL SCALE 0 50 100 FEET

NOTE:
FOR LOCATION OF SECTION A-A', SEE FIGURE 1

FIGURE 4-2A

SECTION A-A'
ALTERNATIVE 2
CONSOLIDATE / CAP IMPOUNDMENT, INCINERATE
HOT SWAMP MATERIALS, SLURRY WALL/CAP
SWAMP FLOOD BERM AND TREAT GROUND WATER

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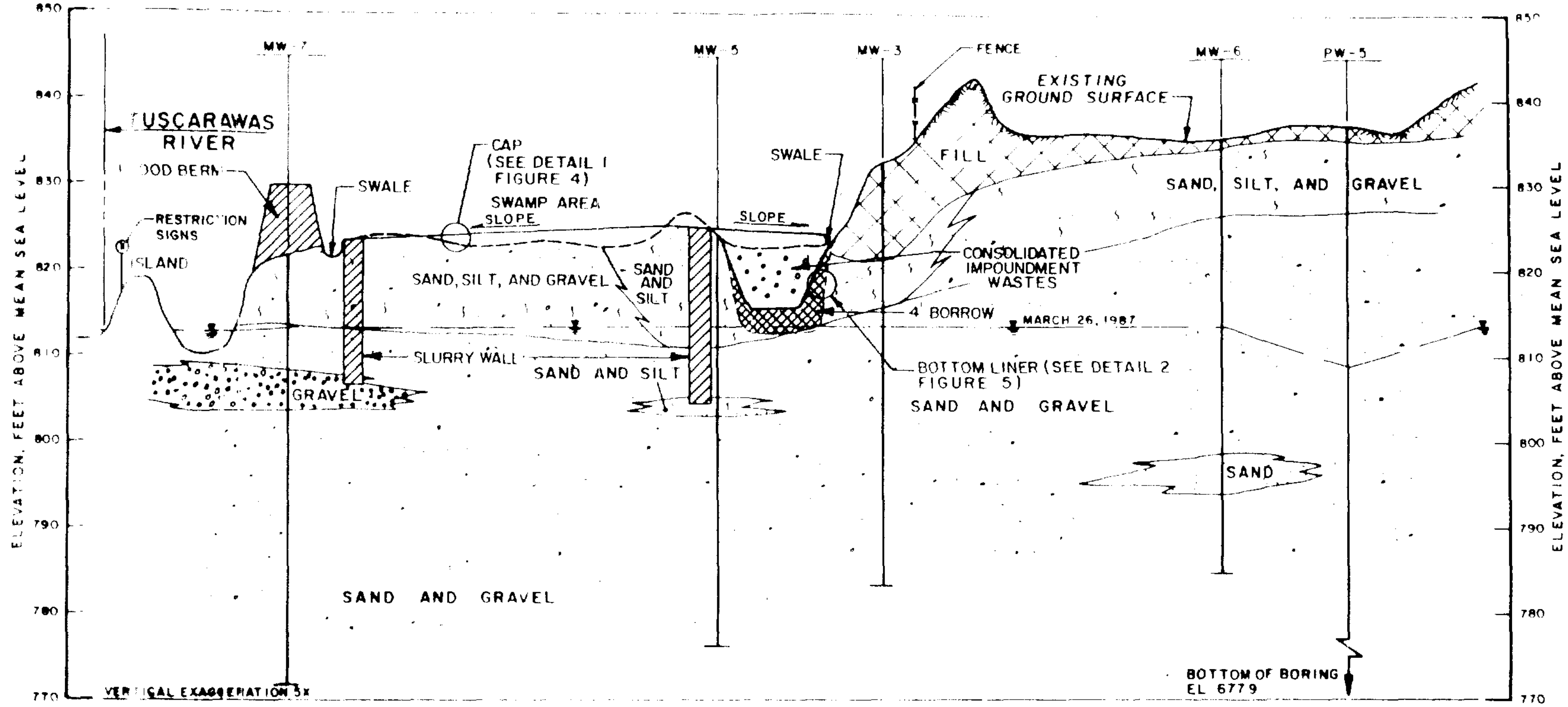

SECTION B-B'

(LOOKING WEST NORTHWEST)

VERTICAL SCALE 0 10 20 FEET

HORIZONTAL SCALE 0 50 100 FEET

NOTE

FOR LOCATION OF SECTION B-B' SEE DWG NO 303613-B8, FIGURE 1

FIGURE 4-2B

SECTION B-B'
ALTERNATIVE 2
CONSOLIDATE / CAP IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, SLURRY WALL/CAP SWAMP FLOOD BERM AND TREAT GROUND WATER

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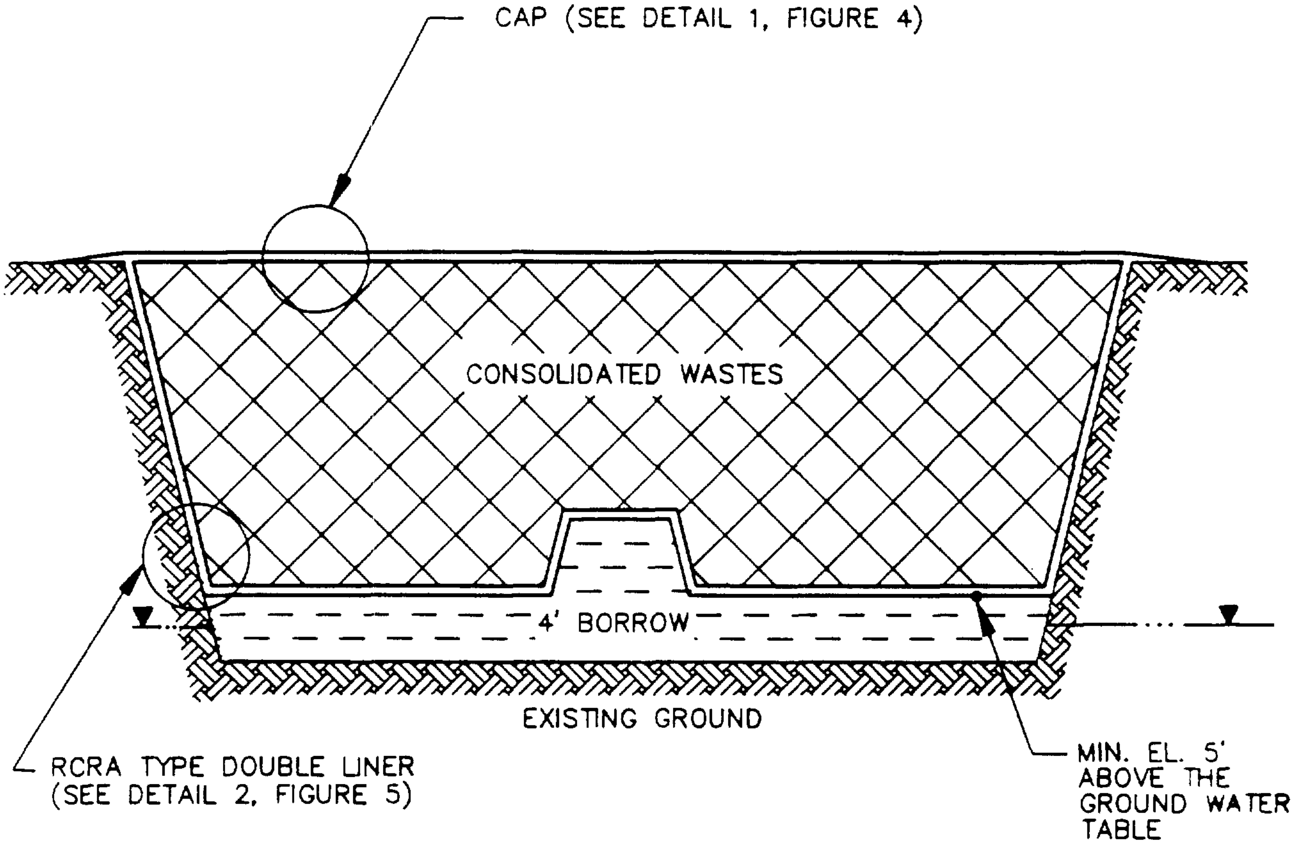

"NOT TO SCALE"

FIGURE 4–3

SOUTHERN AND NORTHERN IMPOUNDMENTS (ALTERNATIVE 2)

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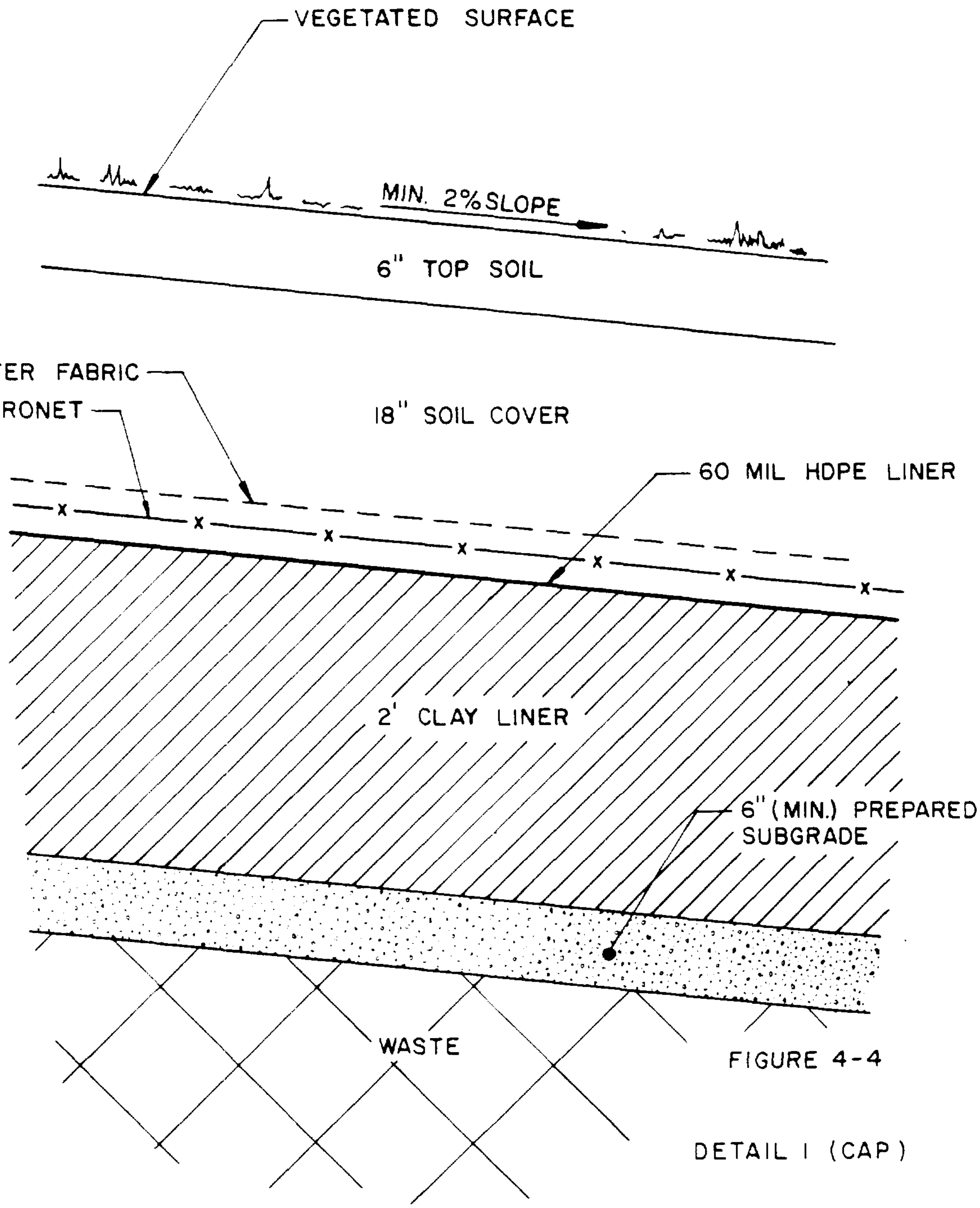

FIGURE 4-4

DETAIL I (CAP)

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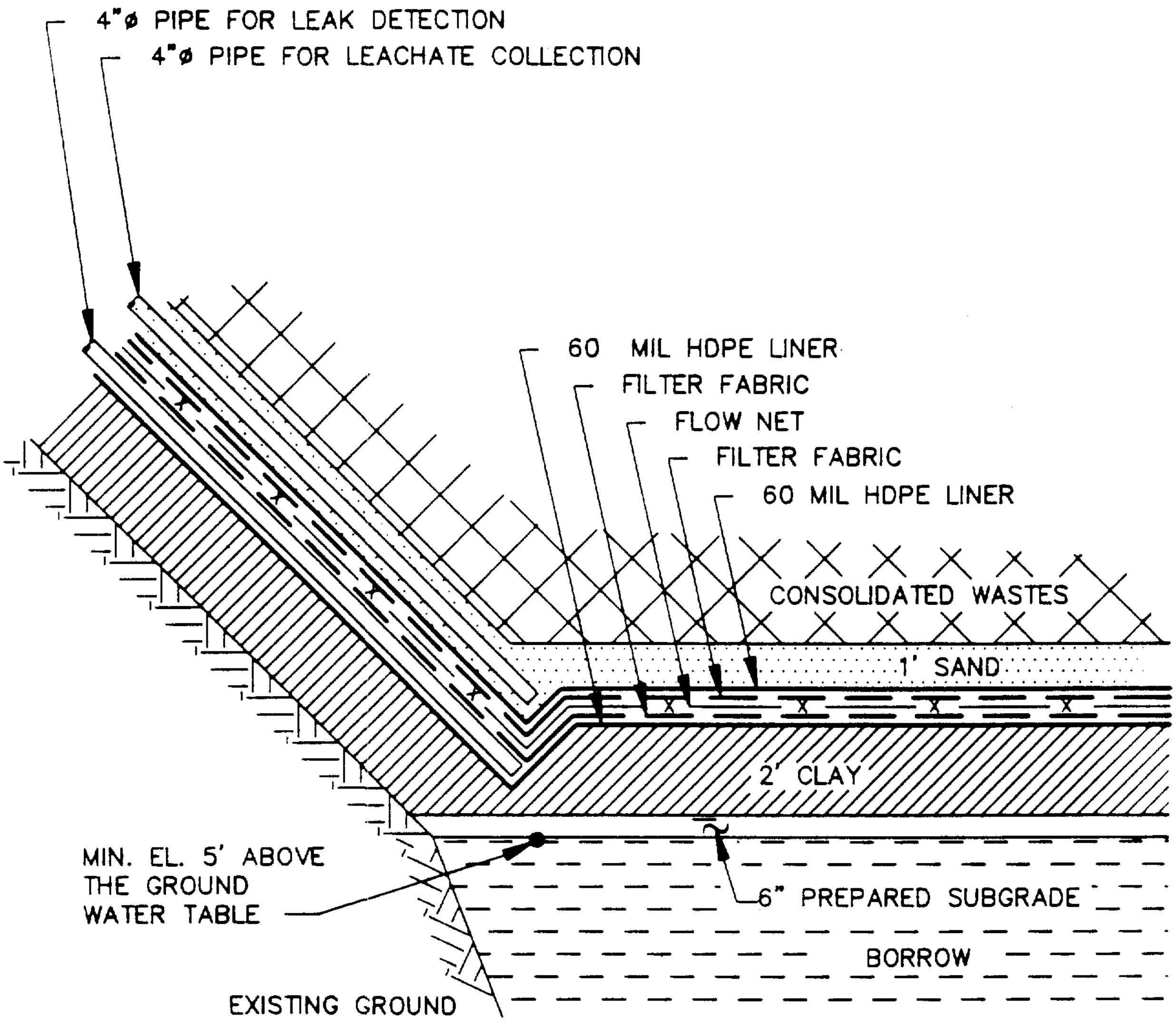
BRUNING 72425



"NOT TO SCALE"

FIGURE 4-5

DETAIL 2
(BOTTOM LINER)

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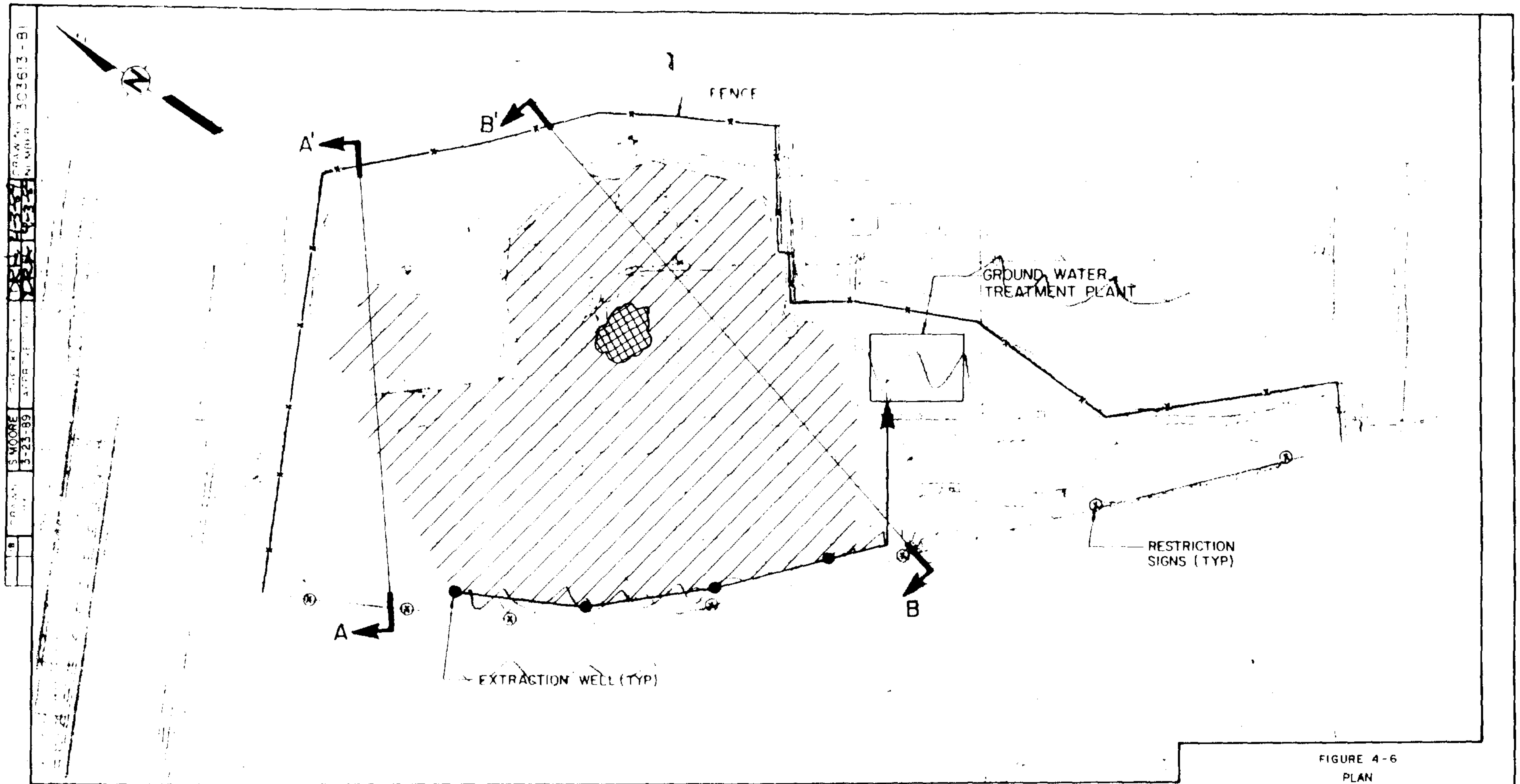

SCALE

0 80 160

MATERIAL TO BE DISPOSED OFF-SITE

MATERIAL TO BE INCINERATED

NOTES

1 FOR SECTION A-A', SEE DRAWING NUMBER 303613-B13, FIGURE 7A

2 FOR SECTION B-B', SEE DRAWING NUMBER 303613-B10, FIGURE 7B

FIGURE 4-6

PLAN

ALTERNATIVE 3
OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT,
INCINERATE HOT SWAMP MATERIALS,
OFF-SITE TREATMENT/DISPOSAL OF REMAINING
F019 SLUDGE IN SWAMP, AND [illegible]
~~TREAT~~ GROUND WATER

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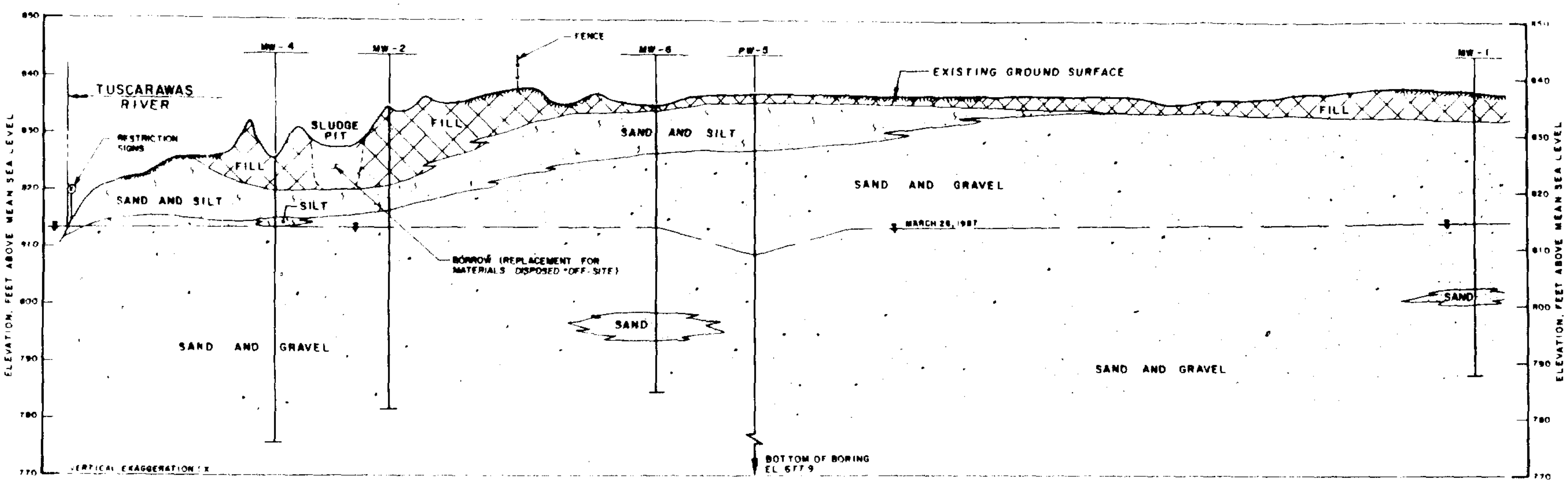

SECTION A-A'

(LOOKING NORTH NORTHWEST)

VERTICAL SCALE 0 10 20 FEET

HORIZONTAL SCALE 0 50 100 FEET

NOTE:
FOR LOCATION OF SECTION A-A', SEE DRAWING NUMBER 303613-B1, FIGURE 6.

FIGURE 4-7A

SECTION A-A'
ALTERNATIVE 3
OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP, AND ~~TREAT~~ Monitor GROUND WATER
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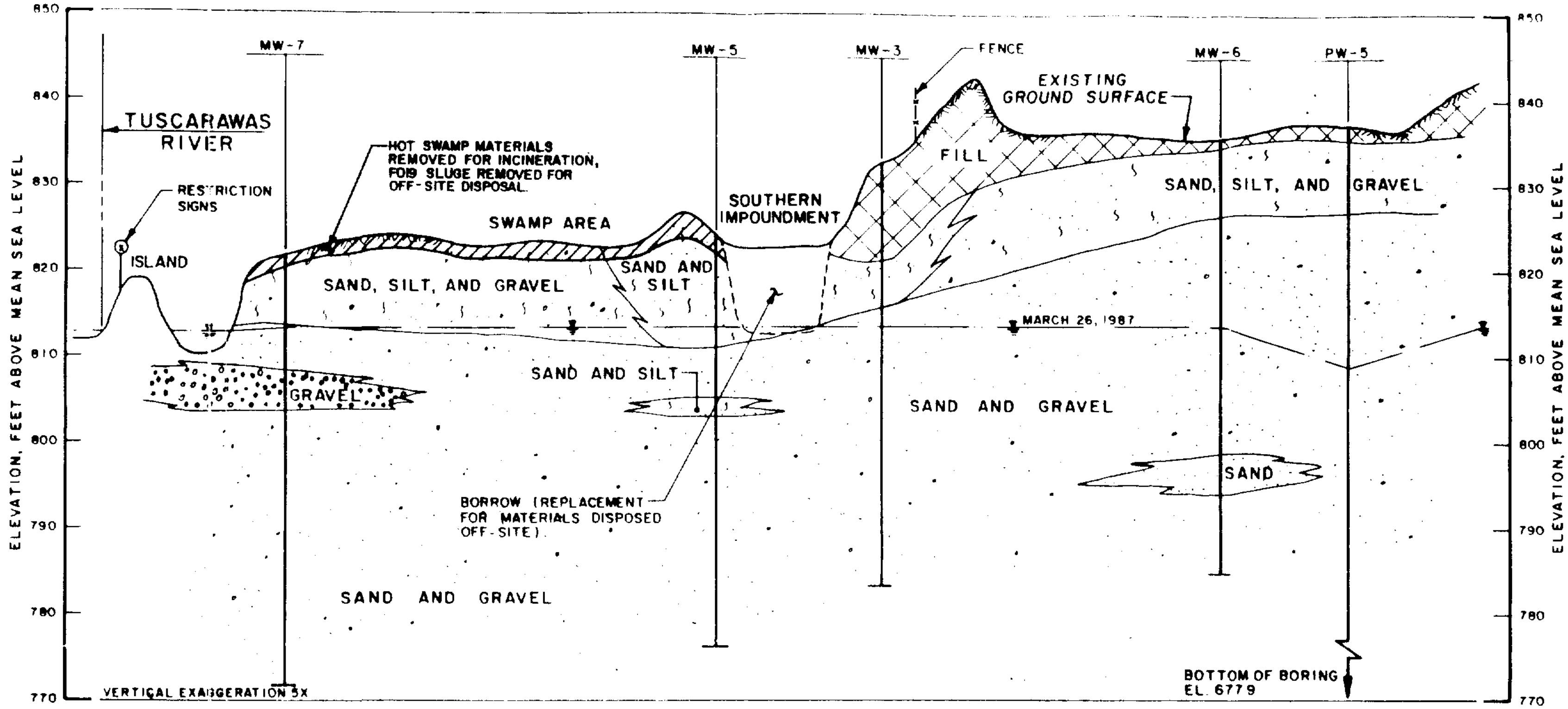

SECTION B-B'

(LOOKING WEST NORTHWEST)

VERTICAL SCALE 0 10 20 FEET

HORIZONTAL SCALE 0 50 100 FEET

NOTE:

FOR LOCATION OF SECTION B-B', SEE DRAWING NUMBER 303613-B1, FIGURE 6

FIGURE 4-7B

SECTION B-B'
ALTERNATIVE 3
OFF-SITE TREATMENT / DISPOSAL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, OFF-SITE TREATMENT / DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP, AND TREAT GROUND WATER
monitor
PREPARED FOR

ATLANTIC RICHFIELD COMPANY
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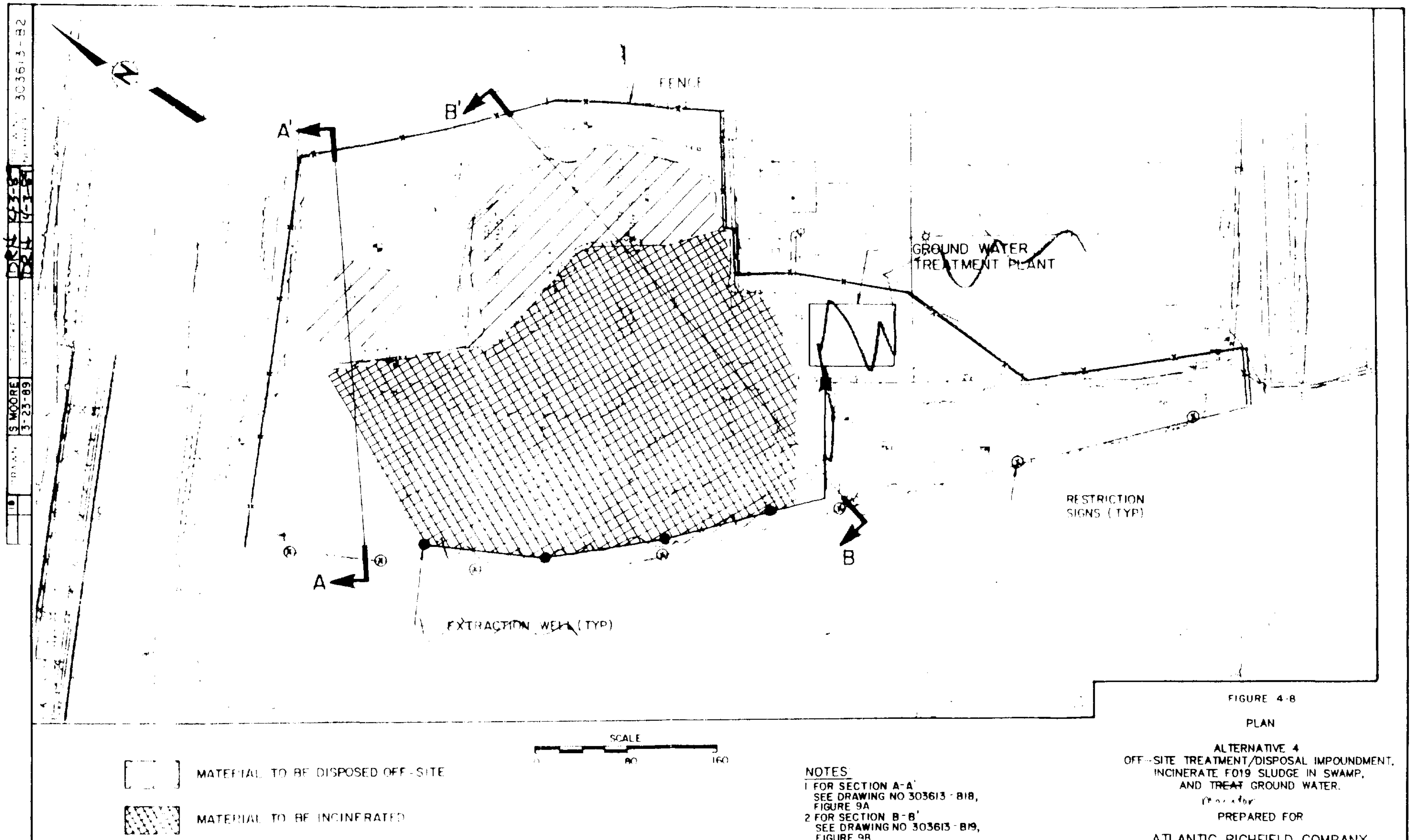
00002179



NOTES
1 FOR SECTION A-A' SEE DRAWING NO 303613-B18, FIGURE 9A
2 FOR SECTION B-B' SEE DRAWING NO 303613-B19, FIGURE 9B

FIGURE 4-8

PLAN

ALTERNATIVE 4
OFF-SITE TREATMENT/DISPOSAL IMPOUNDMENT, INCINERATE F019 SLUDGE IN SWAMP, AND ~~TREAT~~ GROUND WATER.

PREPARED FOR

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DRAWING NUMBER 303613-B18

DRAWN BY HIGGS 3-23-89

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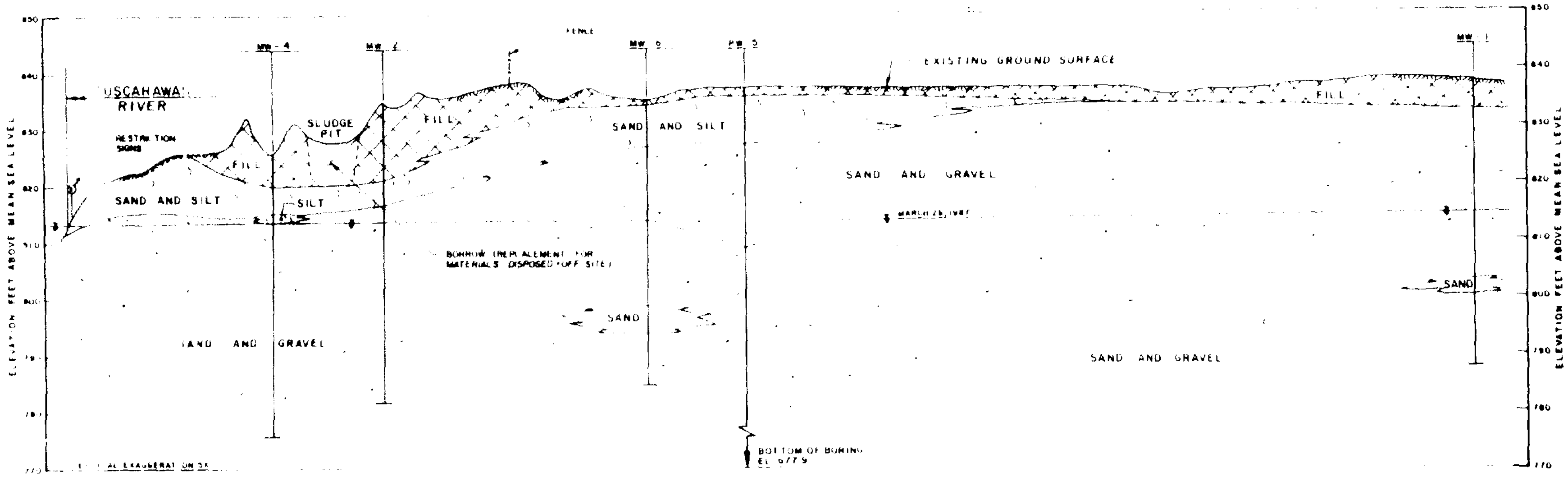

SECTION A-A'

(LOOKING NORTH NORTHWEST)

VERTICAL SCALE 0 10 20 FEET

HORIZONTAL SCALE 0 50 100 FEET

NOTE:

FOR LOCATION OF SECTION A-A', SEE DRAWING NUMBER 303613-B2, FIGURE 8

FIGURE 4-9A

SECTION A-A'

ALTERNATIVE 4

OFF-SITE TREATMENT / DISPOSAL IMPOUNDMENT
INCINERATE F019 SLUDGE IN SWAMP
AND TREAT GROUND WATER

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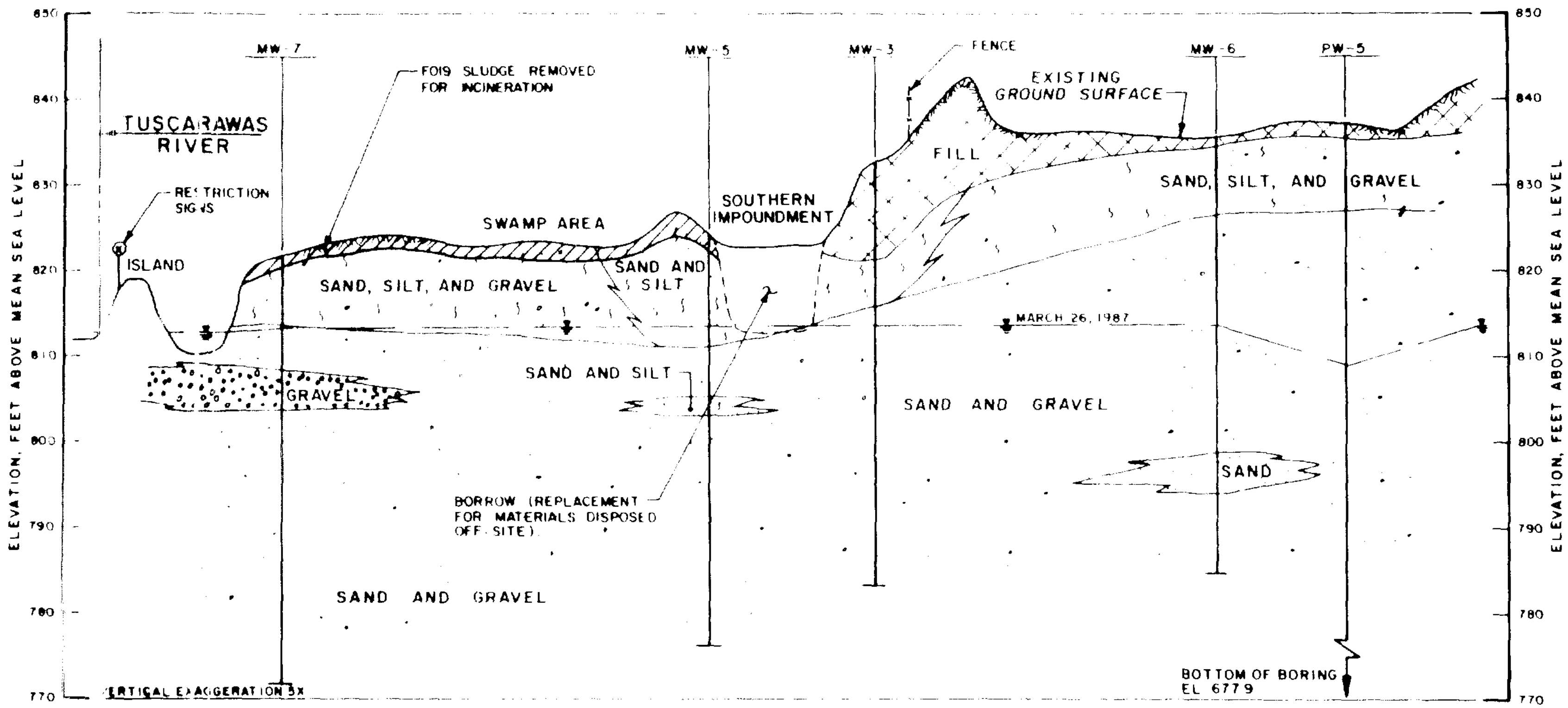

SECTION B-B'

(LOOKING WEST NORTHWEST)

NOTE

FOR LOCATION OF SECTION B-B', SEE DRAWING NUMBER 303613-B2, FIGURE 8

VERTICAL SCALE: 0 10 20 FEET

HORIZONTAL SCALE: 0 50 100 FEET

FIGURE 4-9B

SECTION B-B'
ALTERNATIVE 4
OFF-SITE TREATMENT / DISPOSAL IMPOUNDMENT
INCINERATE F019 SLUDGE IN SWAMP
AND TREAT GROUND WATER
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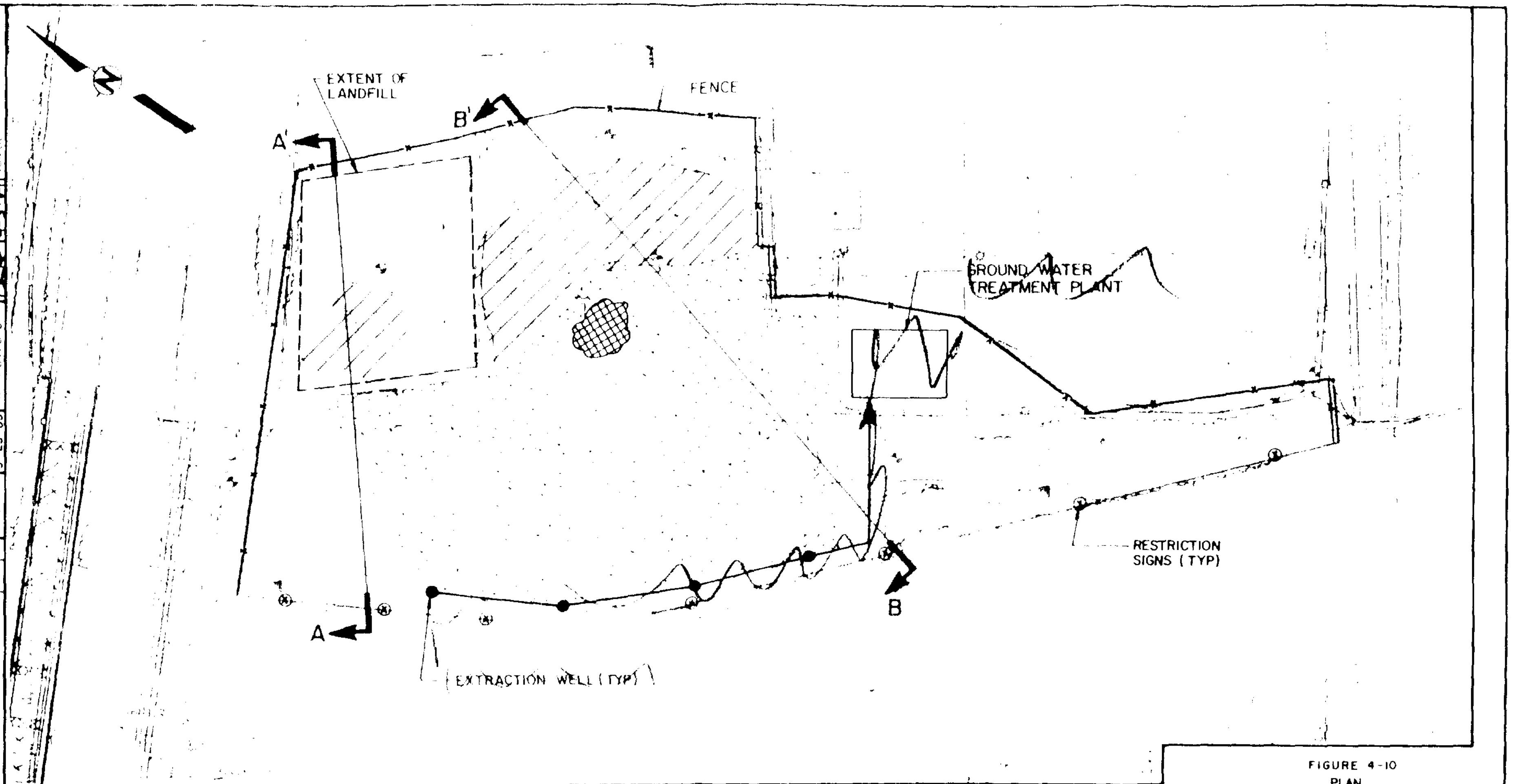

SCALE

0 80 160

MATERIAL TO BE LANDFILLED ON SITE

MATERIAL TO BE INCINERATED

MATERIAL TO BE DISPOSED OFF-SITE

NOTES

1 FOR SECTION A-A', SEE DRAWING NUMBER 303613-B15, FIGURE 11A

2 FOR SECTION B-B', SEE DRAWING NUMBER 303613-B11, FIGURE 11B

FIGURE 4-10

PLAN

ALTERNATIVE 5
ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, OFF-SITE TREATMENT/DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP, AND TREAT GROUND WATER

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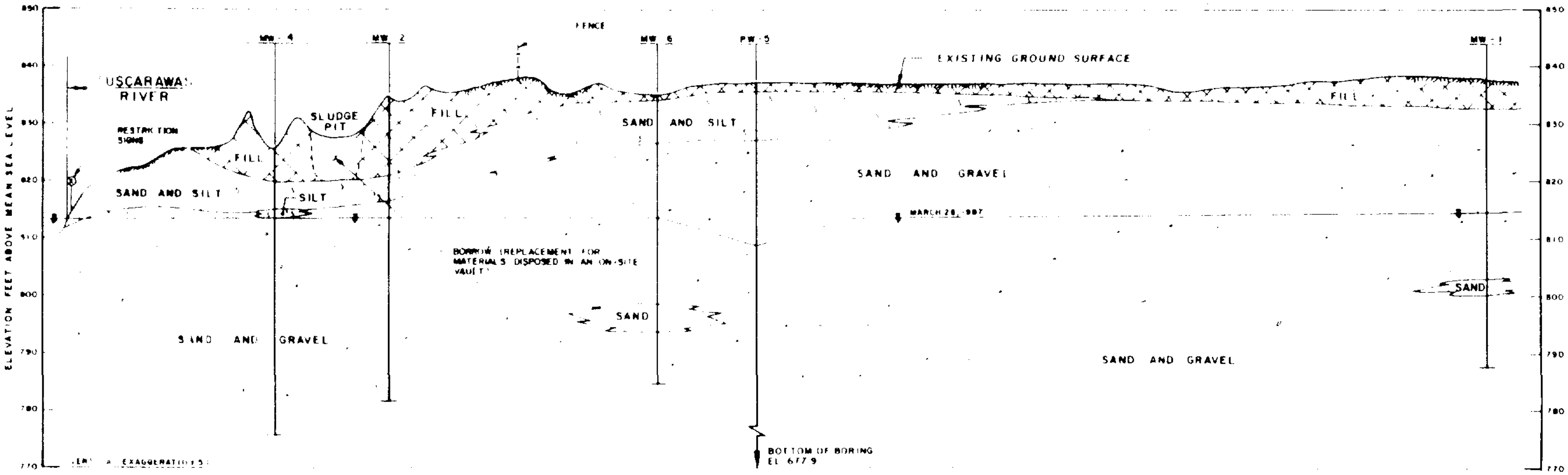

SECTION A-A'

(LOOKING NORTH NORTHWEST)

VERTICAL SCALE 0 10 20 FEET

HORIZONTAL SCALE 0 50 100 FEET

NOTE:

FOR LOCATION OF SECTION A-A', SEE DRAWING NUMBER 303613-B3, FIGURE 10

FIGURE 4-11A

SECTION A-A'
ALTERNATIVE 5
ON-SITE TREATMENT / LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, OFF-SITE TREATMENT / DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP, AND ~~TREAT~~ GROUND WATER
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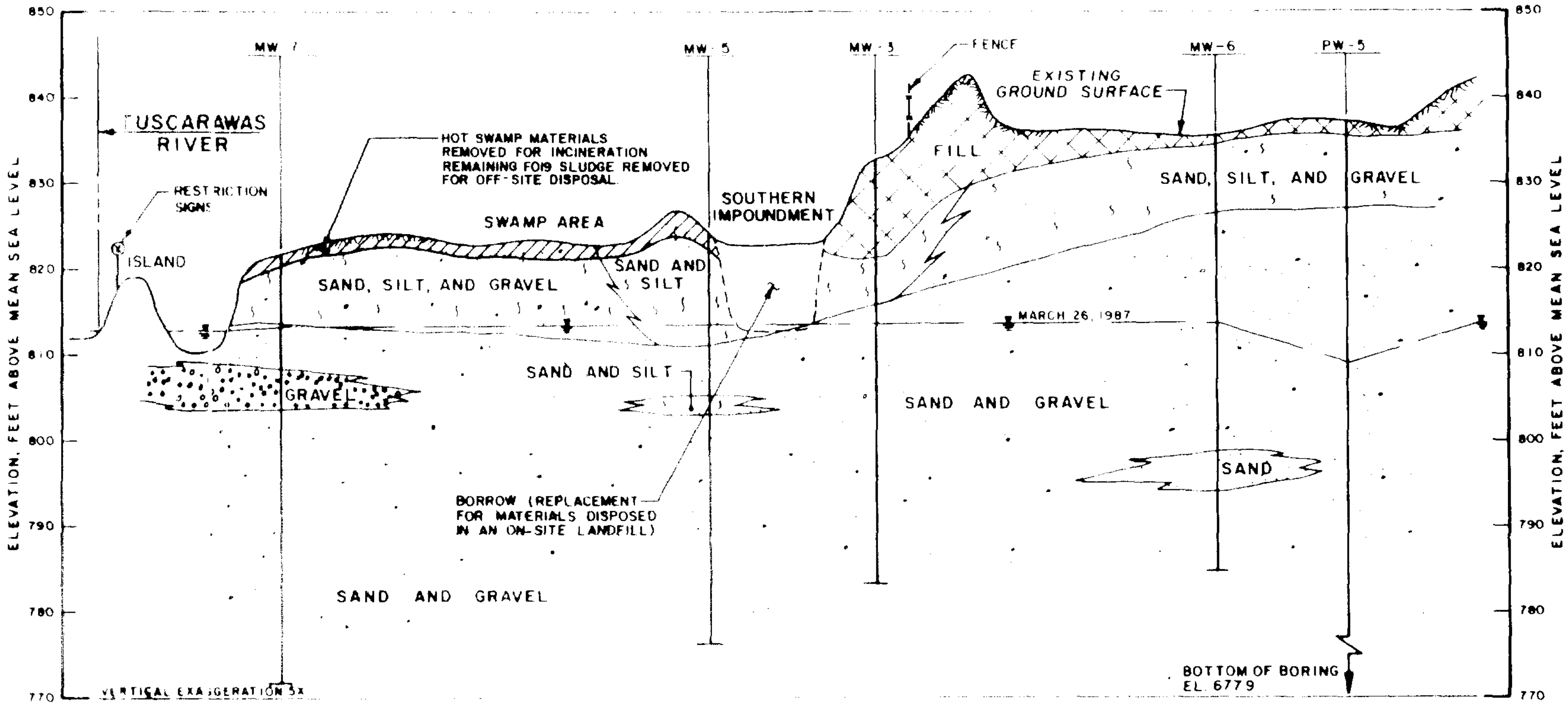

SECTION B-B'

(LOOKING WEST NORTHWEST)

VERTICAL SCALE 0 10 20 FEET

HORIZONTAL SCALE 0 50 100 FEET

NOTE:

FOR LOCATION OF SECTION B-B', SEE DRAWING NUMBER 303613-B3, FIGURE 10

FIGURE 4-11B

SECTION B-B'
ALTERNATIVE 5
ON-SITE TREATMENT / LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, OFF-SITE TREATMENT / DISPOSAL OF REMAINING F019 SLUDGE IN SWAMP, AND ~~TREAT~~ GROUND WATER
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DRAWING NUMBER 303613-B11

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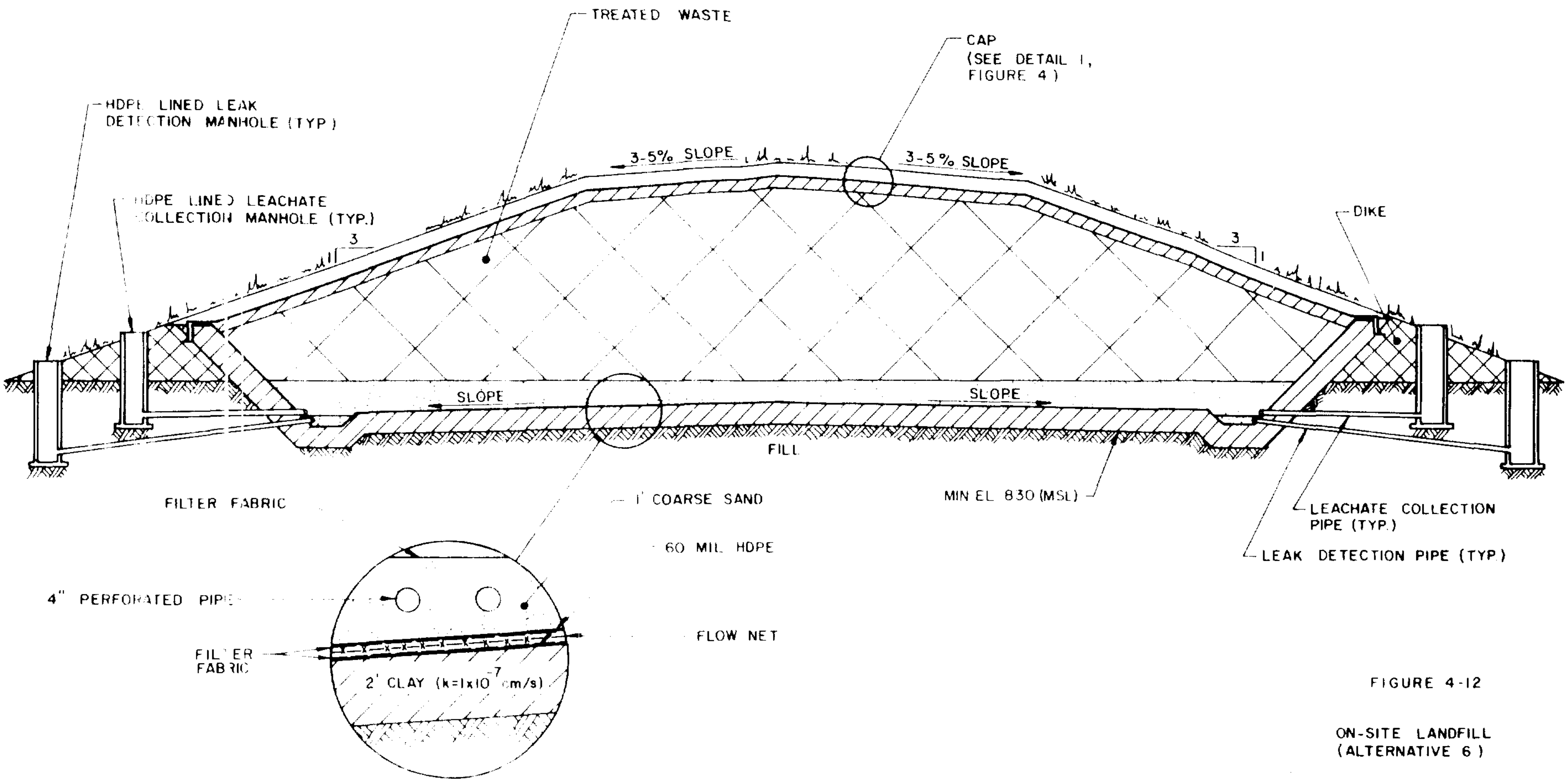

FIGURE 4-12

ON-SITE LANDFILL
(ALTERNATIVE 6)

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CORPORATION

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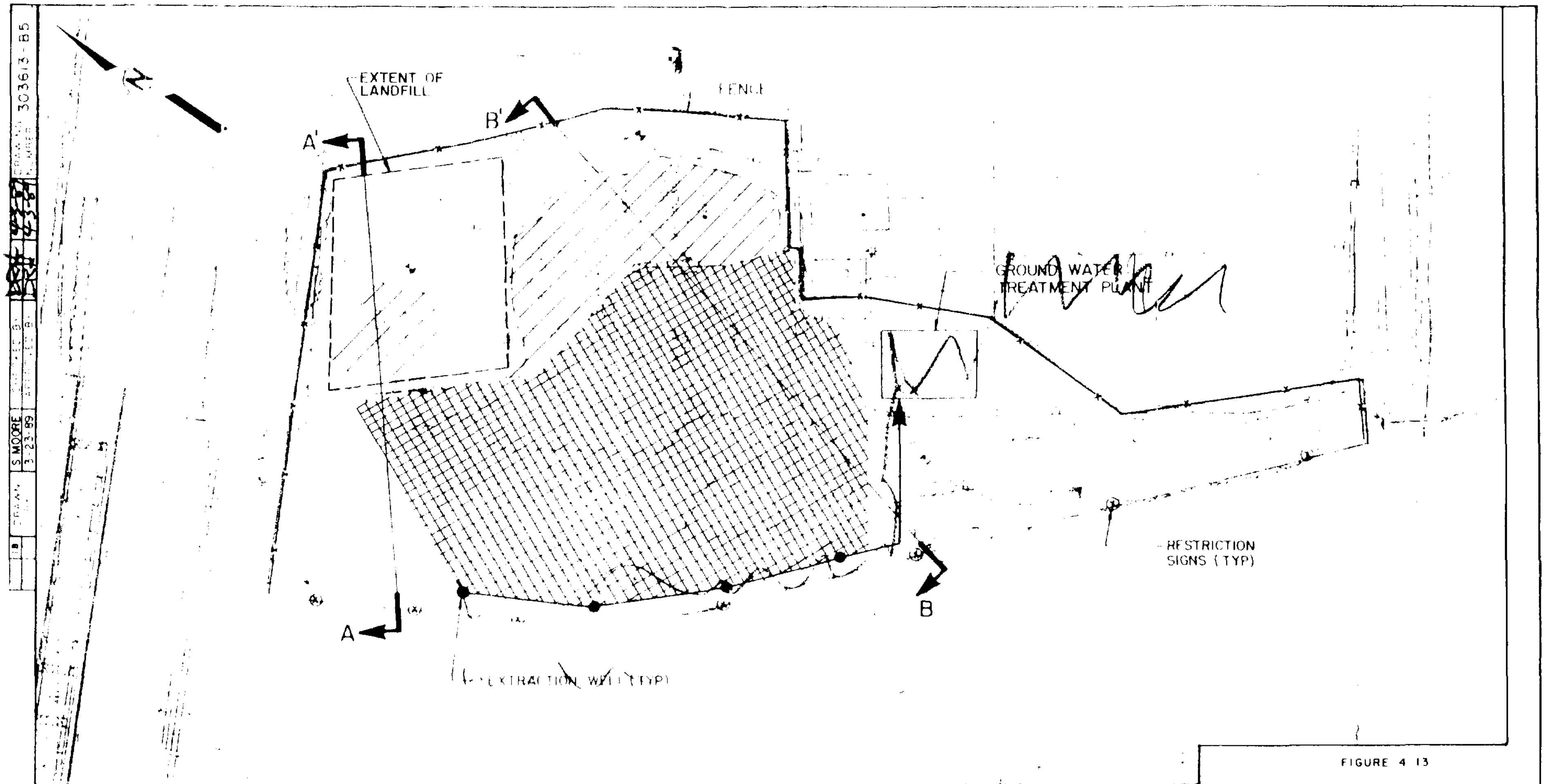

SCALE 0 80 160

MATERIAL TO BE LANDFILLED ON SITE

MATERIAL TO BE INCINERATED

NOTES:

1. FOR SECTION A-A', SEE DRAWING NUMBER 303613 - B16, FIGURE 14A
2. FOR SECTION B-B', SEE DRAWING NUMBER 303613 - B17, FIGURE 14B

FIGURE 4 13

PLAN

ALTERNATIVE 6
ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, AND ~~TREAT~~ monitor GROUND WATER.

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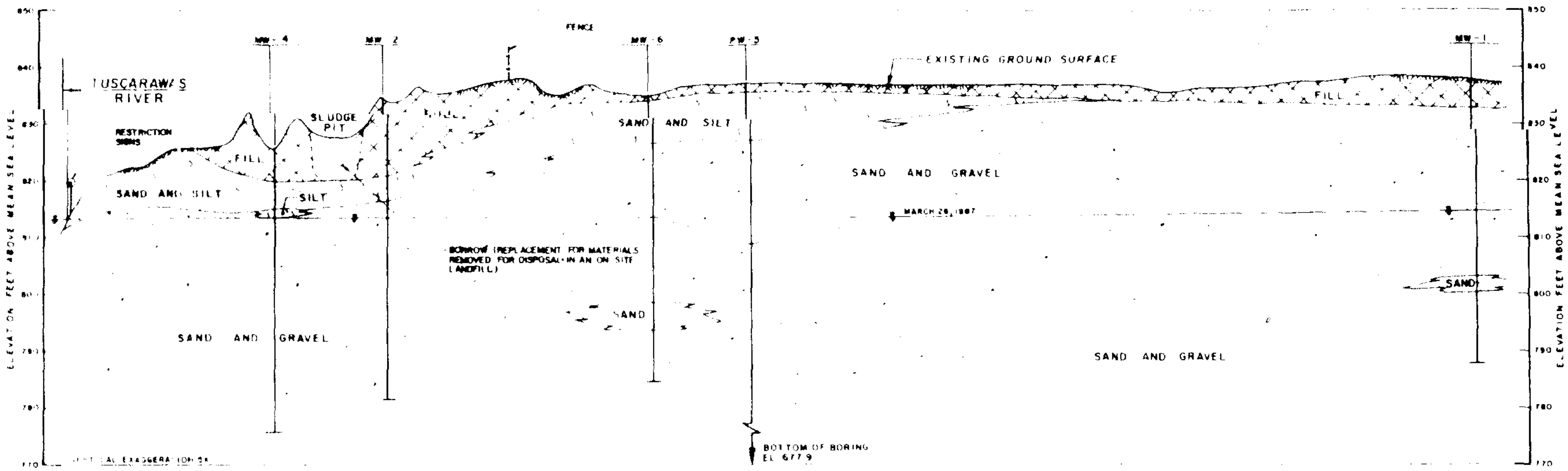

SECTION A-A'

(LOOKING NORTH NORTHWEST)

VERTICAL SCALE 0 10 20 FEET

HORIZONTAL SCALE 0 50 100 FEET

NOTE:

FOR LOCATION OF SECTION A-A', SEE DRAWING NUMBER 303613-B5, FIGURE 13.

FIGURE 4-14A

SECTION A-A'
ALTERNATIVE 6
ON-SITE TREATMENT / LANDFILL IMPOUNDMENT,
INCINERATE HOT SWAMP MATERIALS,
AND ~~TREAT~~ GROUND WATER
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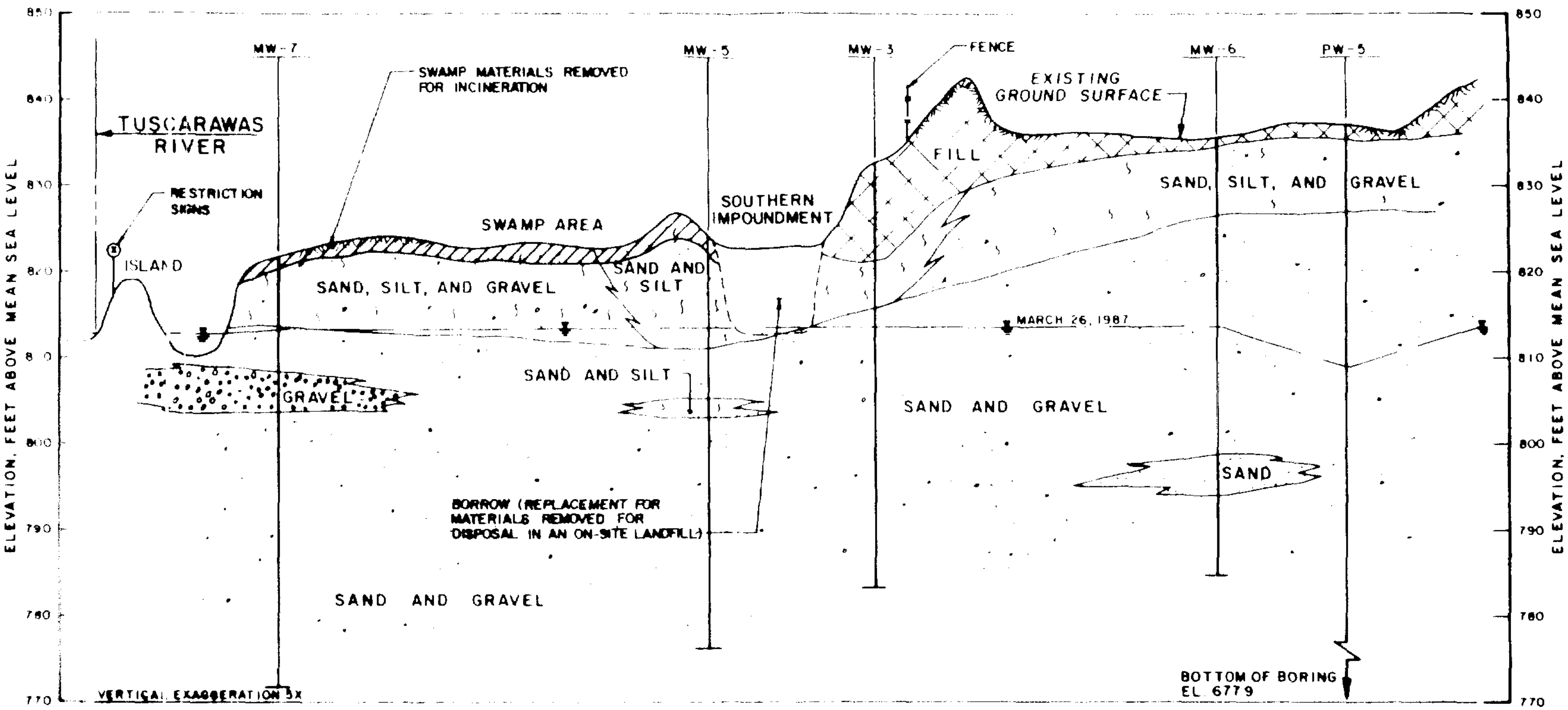

SECTION B-B'

(LOOKING WEST NORTHWEST)

NOTE

FOR LOCATION OF SECTION B-B', SEE DRAWING NUMBER 303613-B5, FIGURE 13

VERTICAL SCALE: 0 10 20 FEET

HORIZONTAL SCALE: 0 50 100 FEET

FIGURE 4-14B

SECTION B-B'

ALTERNATIVE 6

ON-SITE TREATMENT / LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, AND ~~TREAT~~ GROUND WATER

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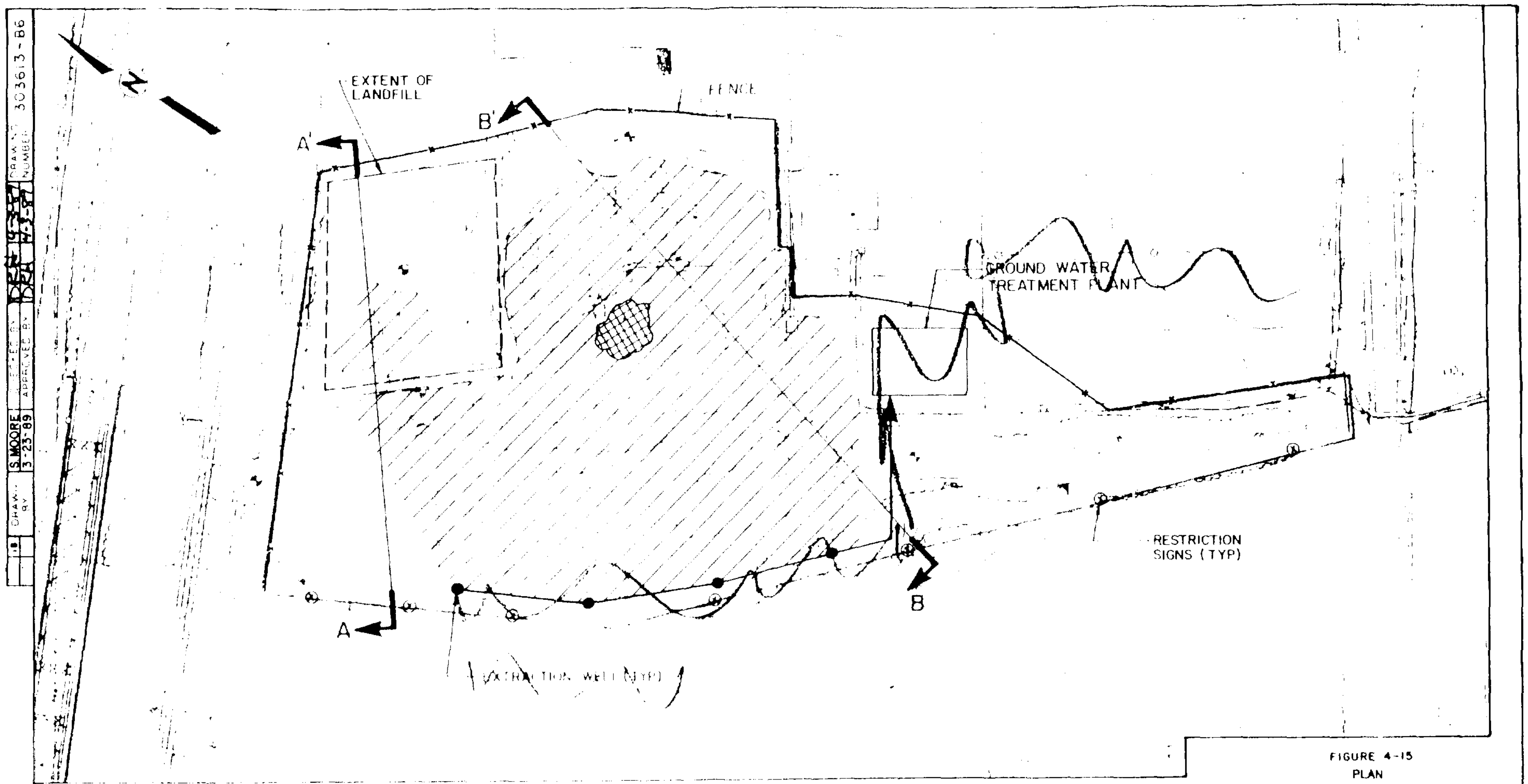

MATERIAL TO BE LANDFILLED ON SITE

MATERIAL TO BE INCINERATED

SCALE 0 80 160

NOTES:
1 FOR SECTION A-A' SEE DRAWING NO 303613-B14, FIGURE 16A
2 FOR SECTION B-B' SEE DRAWING NO 303613-B12, FIGURE 16B

FIGURE 4-15
PLAN
ALTERNATIVE 9
ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, ON-SITE TREATMENT/LANDFILL REMAINING F019 SLUDGE IN SWAMP, AND ~~TREAT~~ GROUND WATER

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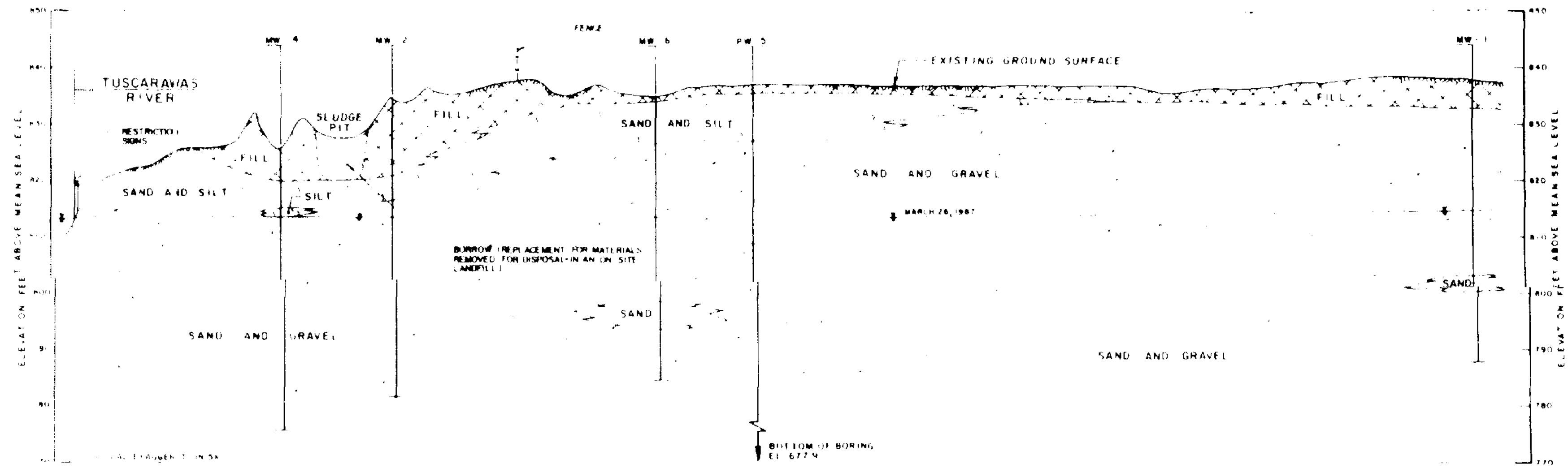

SECTION A-A'

(LOOKING NORTH NORTHWEST)

VERTICAL SCALE 0 10 20 FEET

HORIZONTAL SCALE 0 50 100 FEET

NOTE

FOR LOCATION OF SECTION A-A', SEE *DRAWING NUMBER 303613-B6, FIGURE 15*

DRAWING NUMBER 303613-B14

FIGURE 4-16A

SECTION B-B'
ALTERNATIVE 9
ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, ON-SITE TREATMENT/LANDFILL REMAINING F019 SLUDGE IN SWAMP, AND TREAT GROUND WATER
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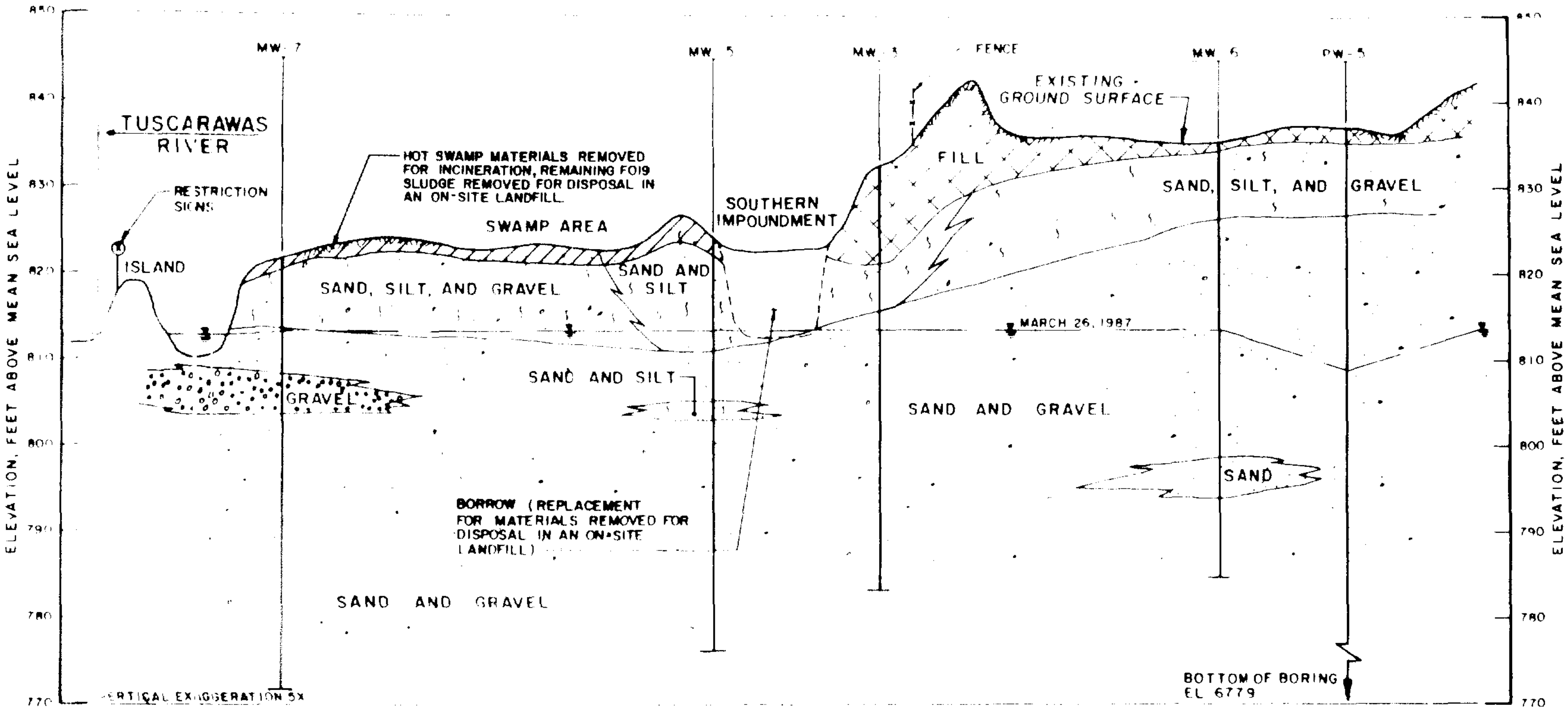
DRAWING NUMBER 303613-B12



SECTION B-B'

(LOOKING WEST NORTHWEST)

VERTICAL SCALE: 0 10 20 FEET

HORIZONTAL SCALE: 0 50 100 FEET

NOTE

FOR LOCATION OF SECTION B-B' SEE DWG NO 303613-36, FIGURE 15

FIGURE 4-16B

SECTION B-B'
ALTERNATIVE 9
ON-SITE TREATMENT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, ON-SITE TREATMENT/LANDFILL REMAINING F019 SLUDGE IN SWAMP, AND TREAT GROUND WATER.
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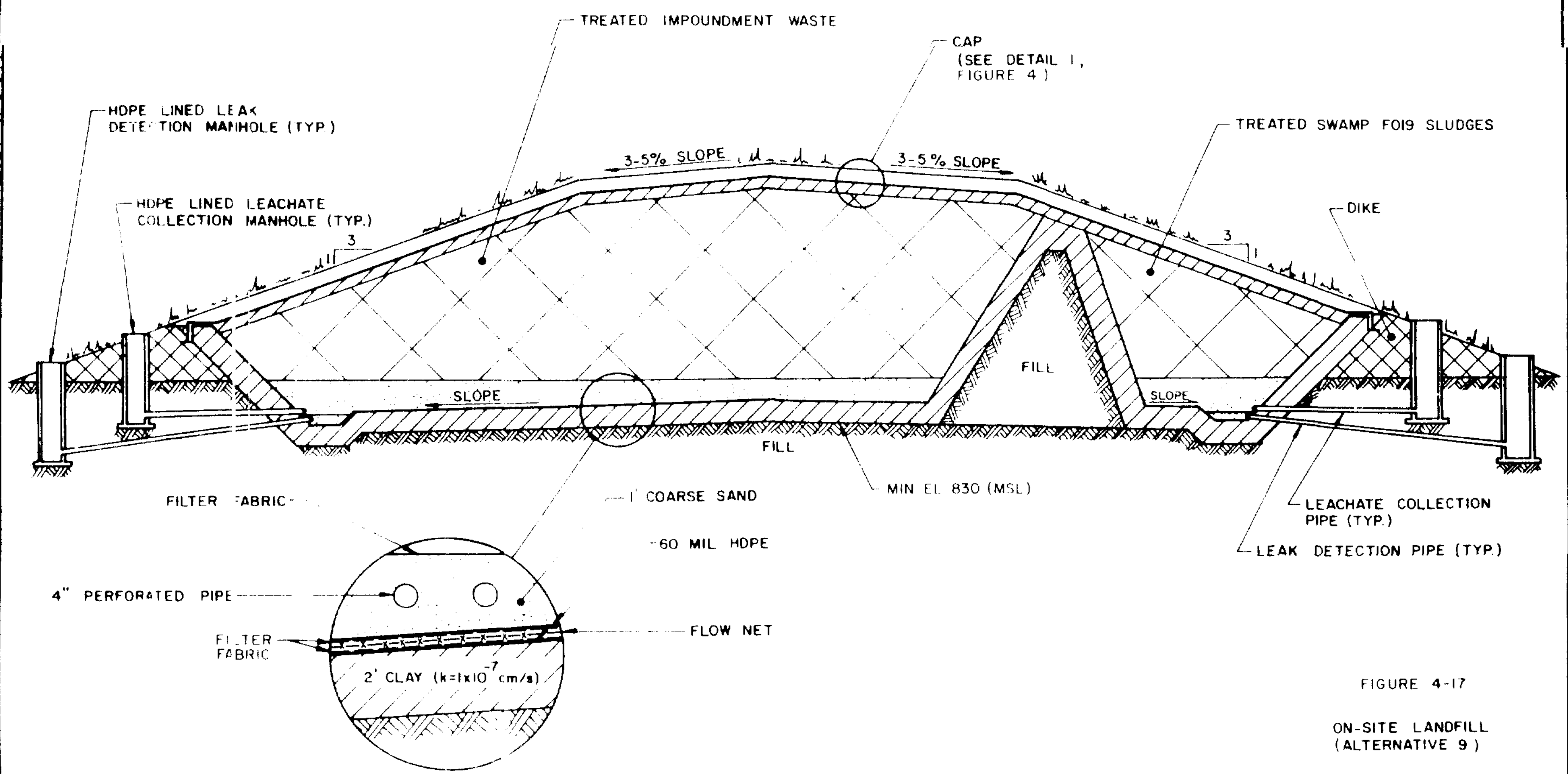

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FIGURE 4-17

ON-SITE LANDFILL
(ALTERNATIVE 9)

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APPENDIX A.

COST SUMMARIES

TABLE A1

SUMMARY OF COST ESTIMATES OF REMEDIAL ACTION ALTERNATIVES

ALTERNATIVE NO.	DESCRIPTION	A CAPITAL COST $	B ANNUAL O&M COSTS $	REFERENCE	C PRESENT(a) WORTH OF O&M COSTS $	A+C TOTAL PRESENT WORTH $
1	NO ACTION (FENCE, MONITOR, DEED RESTRICT.)	$91,000	$67,000		$1,044,718	$1,135,718
2	CONSOLIDATE/CAP IMPOUNDMENT, INCINERATE HOT SWAMP, CAP/SLURRY WALL REMAINING SWAMP, FLOOD BERM, AND TREAT/MONITOR GROUND WATER	$1,637,000	$85,000		$1,325,389	$2,962,389
3	OFF-SITE TREAT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, OFF-SITE TREAT/LANDFILL REMAINING SWAMP F019 MATERIALS, ~~AND TREAT/MONITOR GROUND WATER~~	$4,265,000	$76,000		$1,185,054	$5,450,054
4	OFF SITE TREAT/LANDFILL IMPOUNDMENT, INCINERATE SWAMP MATERIALS, ~~AND TREAT/MONITOR GROUND WATER~~	$7,572,000	$76,000		$1,185,054	$8,757,054
5	ON SITE TREAT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, OFF-SITE TREAT/LANDFILL REMAINING SWAMP F019 MATERIALS, AND ~~TREAT~~/MONITOR GROUND WATER	$5,116,000	$121,000		$1,886,730	$7,002,730
6	ON SITE TREAT/LANDFILL IMPOUNDMENT, INCINERATE SWAMP MATERIALS, AND ~~TREAT~~/MONITOR GROUND WATER	$7,055,000	$121,000		$1,886,730	$8,941,730
7	ON SITE TREAT/LANDFILL IMPOUNDMENT, INCINERATE HOT SWAMP MATERIALS, ON SITE TREAT/LANDFILL REMAINING SWAMP F019 MATERIALS, AND ~~TREAT~~/MONITOR GROUND WATER	$2,817,000	$127,000		$1,980,287	$4,797,287

(a) Present Worth = Annual O&M Costs * Present Worth Factor
Present Worth Factor for a 31-year period based on 10% discount and 5% inflation rates = 15.593

00021194

TABLE A2

ALTERNATIVE 1

CAPITAL COST

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	COMPLIANCE WELLS	1	5	$8,000	$40,000
2	FENCE	FT	2,000	$15	$30,000
3	ENGINEERING @ 15% ITEMS 1 TO 2	x	15	$10,500	$10,500
4	CONTINGENCIES @ 15% ITEMS 1 TO 2	x	15	$10,500	$10,500
				TOTAL	$91,000

0002195

TABLE A2

ALTERNATIVE 1

ANNUAL OPERATION & MAINTENANCE COSTS

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	MONITORING AND STATISTICAL ANALYSIS	1	1	$18,500	$18,500
2	5-YEAR REEVALUATION (a)	1	1	$40,000	$40,000
3	CONTINGENCIES @ 15% ITEMS 1 TO 2	%	15	$8,775	$8,775
				TOTAL	$67,275

(a) $200,000 at the end of every 5 years, prorated over 5 years using Straight Line Depreciation Method

00002196

T A B L E A3

A L T E R N A T I V E 2

C A P I T A L C O S T

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	EXCAVATION, IMPOUNDMENT (TEMPORARY STAGING)	CY	5,300	$15	$79,500
2	SUPPRESSENT FOAM	LS	1	$10,000	$10,000
3	BORROW TO RAISE LEVEL, 4 FEET	CY	2,200	$7	$15,400
4	DOUBLE LINER (SEE TABLE A9)	LS	1	$260,000	$260,000
5	BACKFILL (FROM TEMPORARY STAGING)	CY	5,300	$4	$21,200
6	COMPACT	CY	5,300	$3	$15,900
7	INCINERATION, HOT SWAMP (INCLUDES EXC./HANDLING) (SEE TABLE A13)	CY	50	$1,200	$60,000
8	SLURRY WALL, SWAMP	SF	16,500	$10	$165,000
9	FIELD INVESTIGATION, SLURRY WALL	1	1	$80,000	$80,000
10	CAP, IMPOUNDMENT AND SWAMP (SEE TABLE A10)	SY	8,900	$34	$302,600
11	FLOOD BERM (10 FEET HIGH)	FT	700	$200	$140,000
12	COMPLIANCE WELLS	1	5	$8,000	$40,000
13	EXTRACTION WELLS	1	4	$10,000	$40,000
14	FENCE	FT	2,000	$15	$30,000
15	ENGINEERING @ 15% OF ITEMS 1 TO 15	%	15	$188,940	$188,940
16	CONTINGENCIES @ 15% OF ITEMS 1 TO 15	%	15	$188,940	$188,940
				TOTAL	$1,637,480

00021197

TABLE A3

ALTERNATIVE 2

ANNUAL OPERATION & MAINTENANCE COSTS

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	MONITORING AND STATISTICAL ANALYSIS	1	1	$18,500	$18,500
2	MAINTENANCE AND INSPECTIONS	1	1	$15,000	$15,000
3	5-YEAR REEVALUATION (a)	1	1	$40,000	$40,000
4	CONTINGENCIES @ 15% ITEMS 1 TO 4	X	15	$11,025	$11,025
				TOTAL	$84,525

(a) $200,000 at the end of every 5 years, prorated over 5 years using Straight Line Depreciation Method

0002198

T A B L E A4

A L T E R N A T I V E 3

C A P I T A L C O S T

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	EXCAVATION, IMPOUNDMENT	CY	5,570	$15	$83,550
2	BORROW/BACKFILL/COMPACT, IMPOUNDMENT	CY	5,570	$14	$77,980
3	OFF-SITE LANDFILL, IMPOUNDMENT (SEE TABLE A14)	CY	5,570	$285	$1,587,450
4	EXCAVATION, SWAMP	CY	3,300	$25	$82,500
5	INCINERATION, HOT SWAMP (INCLUDES EXC./HANDLING) (SEE TABLE 13)	CY	50	$1,200	$60,000
6	OFF-SITE LANDFILL, MEDIUM SWAMP (SEE TABLE A14)	CY	650	$820	$533,000
7	OFF-SITE LANDFILL, LOW SWAMP (SEE TABLE A14)	CY	2,600	$285	$741,000
8	SEEDING, SITE	SY	8,900	0.60	$5,340
9	COMPLIANCE WELLS	1	5	$8,000	$40,000
10	EXTRACTION WELLS	1	4	$10,000	$40,000
11	FENCE	FT	2,000	$15	$30,000
12	ENGINEERING @ 15% ITEMS 1 TO 12	%	15	$492,123	$492,123
13	CONTINGENCY @ 15% ITEMS 1 TO 12	%	15	$492,123	$492,123
				TOTAL	$4,265,066

C0002199

TABLE A4

ALTERNATIVE 3

ANNUAL OPERATION & MAINTENANCE COSTS

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	MONITORING AND STATISTICAL ANALYSIS	1	1	$18,500	$18,500
2	MAINTENANCE AND INSPECTIONS	1	1	$8,000	$8,000
3	5-YEAR REEVALUATION (a)	1	1	$40,000	$40,000
4	CONTINGENCIES @ 15% ITEMS 1 TO 4	%	15	$9,975	$9,975
				TOTAL	$76,475

(a) $200,000 at the end of every 5 years, prorated over 5 years using Straight Line Depreciation Method

TABLE A5

ALTERNATIVE 4

CAPITAL COST

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	EXCAVATION, IMPOUNDMENT	CY	5,570	$15	$83,550
2	BORROW/BACKFILL/COMPACT, IMPOUNDMENT	CY	5,570	$14	$77,980
3	OFF-SITE LANDFILL, IMPOUNDMENT (SEE TABLE A14)	CY	5,570	$285	$1,587,450
4	INCINERATION, SWAMP (INCLUDES EXC./HANDLING) (SEE TABLE A13)	CY	3,300	$1,200	$3,960,000
5	SEEDING, SITE	SY	8,900	0.60	$5,340
6	COMPLIANCE WELLS	1	5	$8,000	$40,000
7	EXTRACTION WELLS	1	4	$10,000	$40,000
8	FENCE	FT	2,000	$15	$30,000
9	ENGINEERING @ 15% ITEMS 1 TO 9	%	15	$873,648	$873,648
10	CONTINGENCY @ 15% ITEMS 1 TO 9	%	15	$873,648	$873,648
				TOTAL	$7,571,616

000022201

TABLE A5

ALTERNATIVE 4

ANNUAL OPERATION & MAINTENANCE COSTS

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	MONITORING AND STATISTICAL ANALYSIS	1	1	$18,500	$18,500
2	MAINTENANCE AND INSPECTIONS	1	1	$8,000	$8,000
3	5-YEAR REEVALUATION (a)	1	1	$40,000	$40,000
4	CONTINGENCIES @ 15% ITEMS 1 TO 4	x	15	$9,975	$9,975
				TOTAL	$76,475

(a) $200,000 at the end of every 5 years, prorated over 5 years using Straight Line Depreciation Method

TABLE A6

ALTERNATIVE 5

CAPITAL COST

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	EXCAVATION, IMPOUNDMENT	CY	5,570	$15	$83,550
2	BORROW/BACKFILL/COMPACT, IMPOUNDMENT	CY	5,570	$14	$77,980
3	SUPPRESSENT FOAM, IMPOUNDMENT	LS	1	$30,000	$30,000
4	TREATMENT PAD	1	1	$52,000	$52,000
5	TRANSPORTATION, ON SITE	CY	13,900	$2	$27,800
6	TREATMENT (SOLID WASTES)	CY	5,570	$50	$278,500
7	ON SITE VAULT (RCRA TYPE) (SEE TABLE A12)	1	1	$700,000	$700,000
8	EXCAVATION, SWAMP	CY	3,250	$25	$81,250
9	INCINERATION, HOT SWAMP (INCLUDES EXC./HANDLING) (SEE TABLE A13)	CY	50	$1,200	$60,000
10	OFF SITE LANDFILL, MEDIUM SWAMP (SEE TABLE A14)	CY	650	$820	$533,000
11	OFF SITE LANDFILL, LOW SWAMP (SEE TABLE A14)	CY	2,600	$690	$1,794,000
12	SEEDING, SITE	SY	8,900	0.60	$5,340
13	COMPLIANCE WELLS	1	9	$8,000	$72,000
14	EXTRACTION WELLS	1	4	$10,000	$40,000
15	FENCE	FT	2,000	$15	$30,000
16	TREATABILITY STUDY	1	1	$70,000	$70,000
17	ENGINEERING @ 15% ITEMS 1 TO 17	%	15	$590,313	$590,313
18	CONTINGENCY @ 15% ITEMS 1 TO 17	%	15	$590,313	$590,313
				TOTAL	$5,116,046

TABLE A6

ALTERNATIVE 5

ANNUAL OPERATION & MAINTENANCE COSTS

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	MONITORING AND STATISTICAL ANALYSIS	1	1	$35,000	$35,000
2	MAINTENANCE AND INSPECTIONS	1	1	$30,000	$30,000
3	5-YEAR REEVALUATION (a)	1	1	$40,000	$40,000
4	CONTINGENCIES @ 15% ITEMS 1 TO 4	%	15	$15,750	$15,750
				TOTAL	$120,750

(a) $200,000 at the end of every 5 years, prorated over 5 years using Straight Line Depreciation Method

0002204

TABLE A7

ALTERNATIVE 6

CAPITAL COST

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	EXCAVATION, IMPOUNDMENT	CY	5,570	$15	$83,550
2	BORROW/BACKFILL/COMPACT, IMPOUNDMENT	CY	5,570	$14	$77,980
3	SUPPRESSENT FOAM	LS	1	$30,000	$30,000
4	TREATMENT PAD	1	1	$52,000	$52,000
5	TRANSPORTATION, ON SITE	CY	13,900	$2	$27,800
6	TREATMENT (SOLID WASTES)	CY	5,570	$50	$278,500
7	ON SITE VAULT (RCRA TYPE) (SEE TABLE A12)	1	1	$700,000	$700,000
8	INCINERATION, SWAMP (INCLUDES EXC./HANDLING) (SEE TABLE A13)	CY	3,300	$1,200	$3,960,000
9	SEEDING, SITE	SY	8,900	0.60	$5,340
10	COMPLIANCE WELLS	1	9	$8,000	$72,000
11	EXTRACTION WELLS	1	4	$10,000	$40,000
12	FENCE	SY	2,000	$15	$30,000
13	TREATABILITY STUDY	1	1	$70,000	$70,000
14	ENGINEERING @ 15% ITEMS 1 TO 14	%	15	$814,076	$814,076
15	CONTINGENCY @ 15% ITEMS 1 TO 14	%	15	$814,076	$814,076
				TOTAL	$7,055,321

TABLE A7

ALTERNATIVE 6

ANNUAL OPERATION & MAINTENANCE COSTS

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	MONITORING AND STATISTICAL ANALYSIS	1	1	$35,000	$35,000
2	MAINTENANCE AND INSPECTIONS	1	1	$30,000	$30,000
3	5-YEAR REEVALUATION (a)	1	1	$40,000	$40,000
4	CONTINGENCIES @ 15% ITEMS 1 TO 4	%	15	$15,750	$15,750
				TOTAL	$120,750

(a) $200,000 at the end of every 5 years, prorated over 5 years using Straight Line Depreciation Method

000002206

TABLE A8

ALTERNATIVE 9

CAPITAL COST

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	EXCAVATION, IMPOUNDMENT	CY	5,570	$15	$83,550
2	BORROW/BACKFILL/COMPACT, IMPOUNDMENT	CY	5,570	$14	$77,980
3	SUPPRESSENT FOAM	LS	1	$40,000	$40,000
4	TREATMENT PAD	1	1	$52,000	$52,000
5	TRANSPORTATION, ON SITE	CY	22,000	$2	$44,000
6	TREATMENT (SOLID WASTES)	CY	8,820	$50	$441,000
7	ON SITE VAULT (RCRA TYPE) (SEE TABLE A12)	1	1	$1,050,000	$1,050,000
8	EXCAVATION, SWAMP	CY	3,250	$25	$81,250
9	INCINERATION, HOT SWAMP (INCLUDES EXC./HANDLING) (SEE TABLE A13)	CY	50	$1,200	$60,000
10	SEEDING, SITE	SY	8,900	0.60	$5,340
11	COMPLIANCE WELLS	1	9	$8,000	$72,000
12	EXTRACTION WELLS	1	4	$10,000	$40,000
13	FENCE	SY	2,000	$15	$30,000
14	TREATABILITY STUDY	1	1	$90,000	$90,000
15	ENGINEERING @ 15% ITEMS 1 TO 15	%	15	$325,068	$325,068
16	CONTINGENCY @ 15% ITEMS 1 TO 15	%	15	$325,068	$325,068
				TOTAL	$2,817,256

000022207

TABLE A8

ALTERNATIVE 9

ANNUAL OPERATION & MAINTENANCE COSTS

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	MONITORING AND STATISTICAL ANALYSIS	1	1	$35,000	$35,000
2	MAINTENANCE AND INSPECTIONS	1	1	$35,000	$35,000
3	5-YEAR REEVALUATION (a)	1	1	$40,000	$40,000
4	CONTINGENCIES @ 15% ITEMS 1 TO 4	%	15	$16,500	$16,500
				TOTAL	$126,500

(a) $200,000 at the end of every 5 years, prorated over 5 years using Straight Line Depreciation Method

00002208

TABLE 49

DOUBLE LINER COST

ITEM	QUANTITY	UNIT PRICE	TOTAL
CLAY, 2'	2400 CY	$17	$41,000
60-MIL HDPE	4000 SF	$9	$36,000
HYDRONET	4000 SF	$4	$16,000
60-MIL HDPE	4000 SF	$9	$36,000
SAND AND GRAVEL, 1'	1200 CY	$12	$14,400
FILTER FABRIC	4000 SY	$2	$8,000
LEAK DETECTION & LEACHATE COLLECTION SYSTEMS	LS		$100,000
TOTAL			$251,400
			~ $8/SF

TABLE A10

RCRA CAP UNIT PRICE

ITEM	QUANTITY	UINT PRICE	TOTAL
CLAY, 2'	2/3 CY	$17.0	$11.0
60-MIL HDPE	SY	$9.0	$9.0
HYDRONET	SY	$3.5	$3.5
FILTER FABRIC	SY	$1.5	$1.5
SOIL, 18"	1/2 CY	$12.0	$6.0
TOP SOIL, 6"	1/6 CY	$12.0	$2.0
SEEDING	SY	$0.6	$0.6
	TOTAL		$33.6

~ $34/SY

00002211

TABLE A11

ANNUAL OPERATING COST

GROUND WATER TREATMENT PLANT

ITEM	QUANTITY	UNIT PRICE	TOTAL COST
CHEMICALS:			
HYDRATED LIME	20 TONS	$50	$1,000
CHLORINE	2370 LBS	$0.20	$500
OTERS/POLYMER	LS		$3,500
SLUDGE DISPOSALS	130 TONS	$200	$26,000
LABOR	2920 HRS	$25	$73,000
MAINTENANCE @ 10% OF CAPITAL COST	LS		$160,000
ANALYTICAL	LS		$20,000
ELECTRICAL	LS		$15,000
	SUBTOTAL		$299,000
CONTINGENCY @ 15% OF SUBTOTAL			$44,850
		TOTAL	$343,850
			~ $350,000

TABLE A12

ON - SITE RCRA VAULT

ITEM	QUANTITY	UNIT PRICE	TOTAL
DOUBLE LINER	25,000 SF	$8.0	$200,000.0
DIKE	640 FT	$120.0	$76,800.0
SURFACE PREPARATION	LS		$30,000.0
FILL (10 FEET)	17750 (a) CY	$15.0	$266,250.0
CAP	3100 SY	$34.0	$105,400.0
SEEDING	5500 SY	$0.6	$3,300.0
TOTAL			$681,750.0
			~ $700,000

(a)
43560 SF*10'*110%

TABLE A13

PCBS INCINERATION COST

ITEM	COST, $/CUBIC YARD
INCINERATION COST	700 (a)
PLASTIC DRUM (30 GAL)	135 (b)
LABOR AT 1 HR/DRUM AND	269 (b)
TRANSPORTATION AT $1,8	90
EXCAVATION	25 (b)
TOTAL	~ $1,200

(a) COST FROM CHEM WASTE/MODEL CITY, CHICAGO, IL
(b) ESTIMATED COST

TABLE A14

DISPOSAL COST

ITEM	COST, $/CUBIC YARDS (PCB=0)	COST, $/CUBIC YARDS (0 ppm(PCB(50 ppm)	COST, $/CUBIC YARD (50 ppm(PCB(500 pp
DISPOSAL COST	228 (a)	228 (a)	356 (a)
PLASTIC DRUM (30 GAL)	--	135 (b)	135 (b)
LABOR AT 1 HR/DRUM AND $40/HR	--	269 (b)	269 (b)
TRANSPORTATION AT $1,849 (a)/14	57 (a)	57 (a)	57 (a)
TOTAL	~ $285	~ $690	~ $820

(a) COST FROM CHEM WASTE/MODEL CITY, CHICAGO, IL
(b) ESTIMATED COST

APPENDIX B

APPLICABLE OR RELEVENT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE B.1

FEDERAL ARARS AND OTHER ADVISORIES
OR GUIDELINES TO BE CONSIDERED
CONTAMINANT SPECIFIC
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

- MCL
- 15USC2601 Toxic Substance Control
- 40CFR50 NAAQS
- Section 12 of the Clean Air Act (Public Health Bases to List Pollutants as Hazardous)
- Health Advisories, U.S. EPA Office of Drinking Water Standards
- Federal AWQC
- RfDs, U.S. EPA Office of Research and Development
- Health Effects Assessments
- Carcinogenic Potency Factors, U.S. EPA Environmental Criteria and Assessment Office, U.S. EPA Carcinogen Assessment Group
- 40CFR268.32 California Wastes

TABLE B.2

SITE ARARS AND OTHER ADVISORIES
OR GUIDELINES TO BE CONSIDERED
CONTAMINANT SPECIFIC
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

- ORC6111.042 Regulations Requiring Compliance With National Effluent Standards
- OAC3745-17-08 1(B) Restrictions of Fugitive Dust Emissions
- OWQS
- ORC6111.04 Antidegradation Requirements for Waters of the State

TABLE B.3

FEDERAL ARARS AND OTHER ADVISORIES
OR GUIDELINES TO BE CONSIDERED
LOCATION SPECIFIC
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

- 33CFR320-327 Harbors Act of 1899
- 33CFR320-329 Regulations of Activities Affecting Waters of the United States
- Executive Order 11988 Floodplains Management
- 16USC1531 Endangered Species Act of 1978
- U.S. EPA's Ground Water Protection Strategy
- 16USC661 Fish and Wildlife Improvement Act
- Section 404 of the Clean Water Act of 1977

TABLE B.4

**STATE ARARS AND OTHER ADVISORIES
OR GUIDELINES TO BE CONSIDERED
LOCATION SPECIFIC
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO**

- OAC3745-27-06 Solid Waste Disposal Facility Plan Approval
- OAC3745-54-18 Location Standards
- ORC1502.06 Dams, Dikes, and Levees

TABLE B.5

**FEDERAL ARARS AND OTHER ADVISORIES
OR GUIDELINES TO BE CONSIDERED
ACTION SPECIFIC
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO**

- 40CFR264.310 Landfill Closure Requirements and Postclosure Care
- 40CFR264.92 and 264.99 Ground Water Monitoring
- 29CFR1904, 1910, and 1926 OSHA Requirements
- 49CFR107.1-1711.500 DOT Regulations for Hazardous Materials Transport
- 49CFR170-189 DOT Regulations for Licensed Material Transport
- 40CFR264.116 and 264.117 Use Restrictions
- 40CFR268 Land Disposal Restrictions
- 40CFR264.228 Surface Impoundment Closure and Postclosure Requirements
- TLVs, ACGIH
- 40CFR264, Subpart F RCRA Corrective Action and Ground Water Monitoring Requirements
- 40CFR403 Pretreatment Regulations

TABLE B.6

FEDERAL ARARS AND OTHER ADVISORIES OR GUIDELINES TO BE CONSIDERED ACTION SPECIFIC ALSCO-ANACONDA NPL SITE GNADENHUTTEN, OHIO

- OAC3745-1-05(A) and (B) Antidegradation Policy
- OAC3745-17-11(A) and (B) Permit to Install
- OAC3745-17-11 restriction of Particulate Emission From Industrial Processes
- OAC3745-57-01 Environmental Performance Standards
- OAC3745-66-14 Disposal of Decontamination of Equipment
- OAC3745-50-44 Contents of "Part B" Permit Application
- OAC3745-54-90 Generator Standards
- OAC3745-54-90 Through 99 Ground Water Protection, Ground Water Standards, Point of Compliance, and Monitoring Program
- OAC3745-31-02 Requirements
- OAC3745-31-04 Restrictions
- OAC3745-31-05 Criteria for Decision by the Director
- OAC3745-32-01 Section 401 Water Quality Certification Required
- OAC3745.05(C)(6) Licensing Requirements
- ORC6111.04 Acts of Pollution Prohibited
- ORC6111.45 OEPA Approval of Plans for Disposal of Waste
- ORC3767 Nuisances

APPENDIC C

SUMMARY OF REMEDIAL INVESTIGATION (RI) REPORT

ANALYTICAL DATA

00002223

TABLE C.1

SUMMARY OF GENERAL INORGANIC AND EP TOXICITY METHOD RESULTS[a]
NORTHERN IMPOUNDMENT AREA
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

PARAMETERS	CONCENTRATION UNITS	SLUDGE COMPOSITES-APR. 1985 TOTAL[b]	SLUDGE COMPOSITES-APR. 1985 EP TOX[c]	TEST PIT VERTICAL COMPOSITES-APR. 1985 TP-6 EP TOX	TEST PIT VERTICAL COMPOSITES-APR. 1985 TP-7 EP TOX	TEST PIT VERTICAL COMPOSITES-APR. 1985 TP-8 EP TOX	TEST PIT SAMPLES-APR. 1985 TP-6 3.3-4 FT TOTAL	TEST PIT SAMPLES-APR. 1985 TP-7 1-2 FT TOTAL	TEST PIT SAMPLES-APR. 1985 TP-8 1-2 FT TOTAL	SLUDGE COMPOSITE & SOIL SAMPLE-NOV. 1986: SLUDGE COMPOSITE TOTAL	SLUDGE COMPOSITE EP TOX	S-1 SOIL 9.4-10.0 FT TOTAL	S-1 SOIL 9.4-10.0 FT EP TOX	S-1 SOIL 10.0-10.6 FT TOTAL	S-1 SOIL 10.0-10.6 FT EP TOX	S-3 SOIL 3.8-5.5 FT TOTAL	S-3 SOIL 3.8-5.5 FT EP TOX	S-3 SOIL 5.5-6.5 FT TOTAL	S-3 SOIL 5.5-6.5 FT EP TOX
GENERAL CHEMISTRY																			
pH (1:1)	pH units	8.40	ND[d]	ND	ND	ND	ND	ND	ND	8.20	ND	8.20	ND	8.20	ND	7.80	ND	7.50	ND
Cyanide, Amenable	ppm[e]	0.05U[f]	0.03	0.02U	0.57	0.02U	0.5U	550	400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide Total	ppm	260	0.03	0.02	0.90	0.02U	39	1,200	720	680	0.02U[f]	90	0.02U	8.9	0.02U	37	0.29	21	0.24
Fluoride	ppm	110	1.7	0.9	1.5	7.3	66	110	120	3,900	2.3	360	1.5	240	1.0	180	0.7	170	1.0
Nitrate	ppm	0.4	0.3	0.2	0.4	0.1	ND	ND	ND	1.8U	0.1U	1.2U	0.2	1 2U	0.2	1.2U	0.2	1.2	0.2
METALS																			
Aluminum	ppm	29,000	16	26	7.9	0.12	ND	ND	ND	42 000	0.1U	11,000	5.3	5 000	1.3	7,200	0.5	7,500	0.9
Arsenic	ppm	30	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	32	0.005U	16	0.005U	14	0.005U	12	0.005U	9.6	0.005U
Barium	ppm	130	0.42	0.44	0.76	0.12	ND	ND	ND	43	0.059	79	0.20	81	0.27	100	0.10	110	0.05
Cadmium	ppm	1.0U	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	5.5	0.020	1.0U	0.005U	1.0U	0.005U	1 0U	0.005U	1.0U	0.005U
Calcium	ppm	16,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	0.1U	0.01U	0.01U	0.01U	0.01U	3.1	0.1U	0.1	0.44J[g]	0.01U	1.2U	0.01U	1.0J	0.01U	0.30J	0 01U	0.30J	0.01U
Chromium, Total	ppm	3,300	9.3	8.0	3.9	0.04	46	11 000	7,000	8,800	0.15	1,200	0.09	200	0.01	75	0.02	25	0.01
Copper	ppm	17	0.01U	0.01U	0.01	0.01U	ND	ND	ND	2.9	0.03	62	0.01U	75	0.02	22	0.01U	17	0.01
Iron	ppm	23,000	0.79	7.5	0.50	0.02	31,000	2 700	2,300	2 800	0.13	52,000	11	52 000	49	23,000	0.15	24,000	0.03
Lead	ppm	23	0.10	0.02	0.12	0.13	ND	ND	ND	29	0.005U	9.7	0.005U	9.2	0.005U	12	0.005U	12	0.005U
Magnesium	ppm	19,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	1,000	20	24	30	0.60	1 100	310	300	260	0.44	310	1.2	270	1.3	1,100	6.7	1000	0.6
Mercury	ppm	0.35	0.0002	0.0002U	0.011	0.0025	ND	ND	ND	0.89	0.0002U	0.61	0.0002U	0.53	0.0002U	0.56	0.0002U	0.52	0.0002U
Selenium	ppm	0.1U	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	1.7	0.085	1.9	0.005U	2.3	0.011	1.2	0.01	1.2	0.012
Silicon	ppm	350	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	5.0	0.03	0.34	0.04	0.03	0.10U	0.10U	0.10U	2.2	0.03	2.0U	0.01U	2.0U	0.01U	2.0U	0.01U	2.0U	0.01U
Zinc	ppm	96	0.03	0.02	0.24	0.01U	ND	ND	ND	1,700	0.04	160	0.25	51	0.09	54	0.01	59	0.01

See footnotes at end of table

TABLE C.1
(Continued)

PARAMETERS	CONCENTRATION UNITS	SLUDGE COMPOSITE & SOIL SAMPLE-JAN. 1987 SLUDGE COMPOSITE		S-1 SOIL 8.0-8.8 FT		S-2 SOIL 7.2-8.5 FT		S-3 SOIL 7.0-7.8 FT	
		TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX
GENERAL CHEMISTRY									
pH (1:1)	pH units	8.50	ND	7.85	ND	7.90	ND	8.40	ND
Cyanide Amenable	ppm[e]	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide Total	ppm	5,000	0.02U[f]	230	0.2U	240	0.02U	8.3	0.02U
Fluoride	ppm	3,900	1.8	160	0.3	240	0.8	160	0.5
Nitrate	ppm	1.8U	0.1U	1.1U	0.1	1.2U	0.1U	1.1U	0.16
METALS									
Aluminum	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Barium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	1.8U	0.01U	1.1U	0.01U	1.2U	0.01U	1.1U	0.01U
Chromium, Total	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Iron	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Lead	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	ppm	0.23	0.0002U	0.64	0.0002U	0.10U	0.0002U	0.10U	0.0002U
Selenium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Silicon	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ppm	ND	ND	ND	ND	ND	ND	ND	ND

[a] Samples were collected during the following dates: April 1 to April 8, 1985; November 17 to December 2, 1986; January 26 to January 28, 1987.

[b] The indicated values represent the total concentration in milligrams per kilogram (mg/kg) or parts per million of the corresponding parameter present in the sample.

[c] "EP TOX" refers to E P Toxicity leachate generated by the Extraction Procedure (EP) Toxicity Text Method, SW-1310 as described in U.S. Environmental Protection Agency, 1984, "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," SW-846, Second Edition Revised Waste Characterization Branch, Office of Solid Waste, Washington, D.C.

[d] "ND" indicates not determined.

[e] The limits for total constituent analyses are reported in milligrams per kilogram (mg/kg) or parts per million (ppm). The EP Toxicity Test Method leachate analyses are reported in milligrams per liter (mg/l) or ppm.

[f] "U" indicates that the compound was analyzed but not detected. The corresponding number represents the method detection limit for the sample.

[g] "J" indicates that the corresponding compound is present, but the calculated concentration is less than the specified detection limit

TABLE C.2

SUMMARY OF HAZARDOUS SUBSTANCE LIST COMPOUND RESULTS[a]
NORTHERN IMPOUNDMENT AREA
ALSCO - ANACONDA NPL SITE
GNADENHUTTEN OHIO

PARAMETERS	CAS NUMBER[b]	CONCENTRATION UNITS	SLUDGE COMPOSITE APR. 1985	SLUDGE COMPOSITE NOV. 1986	S-1 SOIL 9.4-10.0 FT NOV. 1986	S-1 SOIL 10.0-10.6 FT NOV. 1986	S-3 SOIL 3.8-5.5 FT NOV. 1986	S-3 SOIL 5.5-6.5 FT NOV. 1986	S-1 VERTICAL COMPOSITE JAN. 1987	S-2 VERTICAL COMPOSITE JAN. 1987	S-3 VERTICAL COMPOSITE JAN. 1987
VOLATILES											
Acetone	67-64-1	mg/kg[c]	ND[d]	0.35J[e]B[f]	0.31B	0.10B	0.075B	0.094B	1.2B	0.22JB	6.9B
Ethybenzene	100-41-4	mg/kg	BDL[g]	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	67-66-3	mg/kg	ND	0.33B	0.075B	0.062B	0.099B	0.079B	0.37B	0.31B	0.33B
2-Hexanone	591-78-6	mg/kg	BDL	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	75-09-2	mg/kg	ND	0.63B[g]	0.075B	0.21B	0.19B	0.29B	0.84B	0.46B	0.77B
Tetrachloroethylene	127-18-4	mg/kg	BDL	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	108-88-3	mg/kg	BDL	ND	ND	ND	ND	ND	ND	ND	ND
Xylene (total)[h]	-	mg/kg	BDL	0.052JB	0.031JB	0.018JB	0.012JB	0.021B	0.072B	BDL	0.13JB
ACID/BASE-NEUTRAL EXTRACTABLES											
Bis (2 ethylhexyl) Phthalate	117-81-7	mg/kg	1.5	ND	BDL	BDL	BDL	BDL	0.48J	1.1J	0.74J
Di-n-butyl phthalate	84-74-2	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	ND	ND	ND
Fluoranthene	206-44-0	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	ND	ND	ND
Isophorone	78-59-1	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	ND	ND	ND
Naphthalene	91-20-3	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	ND	ND	ND
N-Nitrosodiphenylamine (Diphenylamine)[j]	86-30-6	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	ND	ND	ND
Phenanthrene	85-01-8	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	ND	ND	ND
Pyrene	129-00-0	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	ND	ND	ND
PESTICIDES/POLYCHLORINATED BIPHENYLS											
Endrin	72-20-8	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Aroclor 1248	12672-29-6	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	BDL	BDL	BDL

[a] Samples were collected during the following dates: April 1 to April 8, 1985, November 24 and November 25, 1986, January 26 to January 28, 1987.

[b] The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

[c] "mg/kg" indicates milligrams per kilogram or parts per million (ppm).

[d] "ND" indicates not determined.

[e] "J" indicates that the corresponding compound is present but the calculated concentration is less than the specified detection limit.

[f] "B" indicates that the corresponding compound was found in the blank as well as in the sample.

[g] "BDL" indicates not detected above the U.S. Environmental Protection Agency (U.S. EPA) Contract Laboratory Program (CLP) Hazardous Substance List (HSL) Contract Required Detection Limits (CRDL).

[h] Total xylenes include the ortho-, meta, and para-xylene isomers. A CAS number is not available for total xylene.

[i] The indicated compound is detected as the compound in parenthesis.

00002225

TABLE C.3

SUMMARY OF GENERAL-INORGANIC AND EP TOXICITY METHOD RESULTS[a]
SOUTHERN IMPOUNDMENT AREA
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

PARAMETERS	CONCENTRATION UNITS	SLUDGE COMPOSITES-APR 1985 TOTAL[b]	SLUDGE COMPOSITES-APR 1985 EP TOX[c]	TEST PIT VERTICAL COMPOSITES-APR. 1985 TP-9 EP TOX	TP-10 EP TOX	TP-11 EP TOX	TP-12 EP TOX	TP-13 EP TOX	TP-9 2.5 FT	TEST PIT SAMPLES-APR. 1985 TP-9 3 FT	TP-10 1.5 FT	TP-10 6 FT	TP-11 1-3 FT	TP-12 1-2 FT	TP-13 3 FT
GENERAL CHEMISTRY															
pH (1:1)	pH units	9.05	ND[d]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ajanide, Amenable	ppm[e]	0.5U[f]	0.06	0.02U	0.02U	0.02U	0.02U	0.02	0.5U	3 2	0.5U	0.5U	0.5U	820	0.5U
Ajanide, Total	ppm	320	0.06	0.02	0.02	0.04	0.02U	0.16	22	8.0	1,500	0.8	660	890	210
Fluoride	ppm	84	11	0.9	2.5	12	14	3.5	120	35	12	21	100	12	18
Nitrate	ppm	0.3	0.1U	0.1U	0.2U	0.7	0.2	4.6	ND	ND	ND	ND	ND	ND	ND
METALS															
Aluminum	ppm	22,000	0.01	47	7.4	0.01U	0.01U	1.3	ND	ND	ND	ND	ND	ND	ND
Arsenic	ppm	14	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	ND	ND	ND	ND
Barium	ppm	75	0.18	0.78	0.36	0.13	0.14	0.07	ND	ND	ND	ND	ND	ND	ND
Cadmium	ppm	2.0	0.01U	0.01U	0.01U	0.01U	0.01U	0.02	ND	ND	ND	ND	ND	ND	ND
Calcium	ppm	27,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	0.1U	0.01U	0.01U	0.01U	0.12	0.01	0.04	0.1U	0.6	0.1U	0.1U	0.1U	0.1U	0.1U
Chromium, Total	ppm	4,200	0.09	11	1.7	0.15	0.11	0.13	30	240	9,800	33	5,500	8,400	2,200
Copper	ppm	12	0.01U	0.01U	0.01U	0.01U	0.01U	0.05	ND	ND	ND	ND	ND	ND	ND
Iron	ppm	10,000	0.01	40	0.66	0.01	0.01U	0.18	29,000	9,700	1,800	24,000	3,100	1,700	1,900
Lead	ppm	170	0.12	0.56	0.13	0.09	0.14	0.37	ND	ND	ND	ND	ND	ND	ND
Magnesium	ppm	47,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	610	0.50	22	8.8	0.03	0.06	0.08	1,000	250	270	790	230	180	120
Mercury	ppm	18	0.0056	0.011	0.0002U	0.0025	0.0002U	0.016	ND	ND	ND	ND	ND	ND	ND
Selenium	ppm	0.1U	0.01U	0.010	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	ND	ND	ND	ND
Silicon	ppm	300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	4.0	0.03	0.16	0.04	0.02	0.03	0.07	0.1U	0.23	0.1U	0.1U	0.1U	0.1U	0.1U
Zinc	ppm	980	0.01U	1.2	0.03	0.01U	0.01U	0.01U	ND	ND	ND	ND	ND	ND	ND

See footnotes at end of table

C000222

TABLE C.3
(Continued)

PARAMETERS	CONCENTRATION UNITS	SLUDGE COMPOSITE & SOIL SAMPLE-NOV. 1987: SLUDGE COMPOSITE		S-4 SOIL 6.0-8.0 FT		S-5 SOIL 9.5-11.0 FT		S-6 SOIL 10.1-11.4 FT		SLUDGE COMPOSITE SAMPLE-JAN. 1987: SLUDGE COMPOSITE		S-4 SOIL 8.0-9.0 FT		S-5 SOIL 8.5-9.0 FT		S-6 SOIL 9.5-10.1 FT	
		TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX
GENERAL CHEMISTRY																	
pH (1:1)	pH units	8.4	ND	8.3	ND	8.2	ND	8.6	ND	8.90	ND	7.75	ND	8.50	ND	8.60	ND
Cyanide, Amenable	ppm[e]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide Total	ppm	490	0.02	1.6	1.02	18	0.02	25	0.02	440	0.02U	170	0.02U	35	0.02U	120	0.02U
Fluoride	ppm	3,400	6.1	58	0.02	190	0.02	310	1.1	2,300	4.5	160	1.1	290	0.9	570	0.6
Nitrate	ppm	1.8	0.1	1.2	0.4	1.2	0.3	4.6	0.4	1.8U	0.1U	1.3U	0.1U	1.2U	0.1U	1.3U	0.1U
METALS																	
Aluminum	ppm	34,600	0.245	8,240	0.161	6,460	1.62	5,560	2.72	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	ppm	20	0.005U	7.1	0.005U	10U	0.005U	7.5	0.005U	ND	ND	ND	ND	ND	ND	ND	ND
Barium	ppm	32	0.82	11.3	0.273	64	0.258	32	0.184	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	ppm	4.7	0.014	1.0U	0.005U	1.0U	0.005U	1.0U	0.005U	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	ppm	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	4.4	0.01	3.6	0.01	3.0	0.01	1.3	0.01	1.8U	0.03	3.6U	0.01U	3.0U	0.01U	1.3U	0.01U
Chromium, Total	ppm	5,760	0.012	19	0.012	212	0.022	410	0.044	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ppm	2.6	0.023	15	0.010	48	0.012	61	0.024	ND	ND	ND	ND	ND	ND	ND	ND
Iron	ppm	2,410	0.119	24,300	2.0	30,300	20.7	31,100	47.9	ND	ND	ND	ND	ND	ND	ND	ND
Lead	ppm	15	0.005U	13	0.005U	13	0.005U	8.3	0.005U	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	ppm	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	217	0.70	764	9.49	365	2.32	308	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	ppm	0.58	0.002U	0.71	0.0002U	0.5	0.0002U	0.41	0.0002U	1.3	0.0003	0.12	0.0002U	0.29	0.0002U	0.27	0.0002
Selenium	ppm	[illegible]	0.132	1.4	0.016	1.1	0.019	1.3	0.027	ND	ND	ND	ND	ND	ND	ND	ND
Silicon	ppm	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	2.1	0.025	2.0U	0.01	2.0U	0.01U	2.0U	0.017	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ppm	754	0.028	56	0.013	62	0.093	62	0.171	ND	ND	ND	ND	ND	ND	ND	ND

[a]Samples were collected during the following dates: April 1 to April 8, 1985, November 17 to December 2, 1986; January 26 to January 28, 1987.

[b]The indicated values represent the total concentration in milligrams per kilogram (mg/kg) or parts per million of the corresponding parameter present in sample.

[c]"EP TOX" refers to EP Toxicity leachate generated by the Extraction Procedure (EP) Toxicity Text Method, SW-1310 as described in U.S. Environmental Protection Agency, 1984, "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," SW-846, Second Edition Revised, Waste Characterization Branch, Office of Solid Waste, Washington D.C.

[d]"ND" indicates not determined

[e]The limits for total constituent analyses are reported in milligrams per kilogram (mg/kg) or parts per million (ppm). The EP Toxicity Test Method leachate analyses are reported in milligrams per liter (mg/ℓ) or ppm.

[f]"U" indicates that the compound was analyzed but not detected. The corresponding number represents the method detection limit for the sample.

0002227

TABLE C.4

SUMMARY OF HAZARDOUS SUBSTANCE LIST COMPOUND RESULTS[a]
SOUTHERN IMPOUNDMENT AREA
ALSCO - ANACONDA NPL SITE
GNADENHUTTEN, OHIO

PARAMETERS	CAS NUMBER[b]	CONCENTRATION UNITS	SLUDGE COMPOSITE APR. 1985	SLUDGE COMPOSITE NOV. 1986	S-4 SLUDGE COMPOSITE NOV. 1986	S-5 SLUDGE COMPOSITE NOV. 1986	S-6 SLUDGE COMPOSITE NOV. 1986	S-4 SOIL 6.0-8.0 FT NOV. 1986	S-5 SOIL 9.5-11 FT NOV. 1986	S-6 SOIL 10.1-11.4 FT NOV. 1986
VOLATILES										
Acetone	67-64-1	mg/kg[c]	ND[d]	0.48B[e]	ND	ND	ND	0.077J[f]B	0.20B	0.12B
Ethylbenzene	100-41-4	mg/kg	110	ND	ND	ND	ND	ND	ND	ND
Chloroform	67-66-3	mg/kg	ND	0.29B	ND	ND	ND	0.072JB	0.035JB	0.034JB
2-Hexanone	591-78-6	mg/kg	43	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	75-09-2	mg/kg	ND	0.78B	ND	ND	ND	0.25B	0.025JB	0.021JB
Tetrachloroethylene	127-18-4	mg/kg	0.28	ND	ND	ND	ND	ND	ND	ND
Toluene	108-88-3	mg/kg	5.3	ND	ND	ND	ND	ND	ND	ND
Xylene, Total[g]	-	mg/kg	410	0.88B	ND	ND	ND	0.062JB	0.015J	0.018J
ACID/BASE-NEUTRAL EXTRACTABLES										
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	1.1	ND	BDL[h]	BDL	BDL	BDL	BDL	BDL
Di-n-butyl phthalate	84-74-2	mg/kg	0.80	ND	BDL	BDL	BDL	BDL	BDL	BDL
Fluoranthene	206-44-0	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	BDL	BDL
Isophosone	78-59-1	mg/kg	16	ND	BDL	BDL	BDL	BDL	BDL	BDL
Naphthalene	91-20-3	mg/kg	200	ND	BDL	BDL	BDL	BDL	BDL	BDL
N-Nitrosodiphenylamine (Diphenylamine)[i]	86-30-6	mg/kg	0.45	ND	BDL	BDL	BDL	BDL	BDL	BDL
Phenanthrene	85-01-8	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	BDL	BDL
Pyrene	129-00-0	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	BDL	BDL
PESTICIDES/POLYCHLORINATED BIPHENYLS										
Endrin	72-70-8	mg/kg	0.066	ND	ND	ND	ND	ND	ND	ND
Aroclor 1248	12672-29-6	mg/kg	BDL	ND	ND	ND	ND	ND	ND	ND

C002228

TABLE
(Conti...)

PARAMETERS	CAS NUMBER	CONCENTRATION UNITS	S-4 VERTICAL COMPOSITE JAN. 1987	S-5 VERTICAL COMPOSITE JAN. 1987	S-6 VERTICAL COMPOSITE JAN. 1986	S-4 SOIL 8.0-9.0 FT JAN. 1987	S-5 SOIL 8.5-9.0 FT JAN. 1987	S-6 SOIL 9.5-10.1 FT JAN. 1987
VOLATILES								
Acetone	67-64-1	mg/kg	0.28JB	1 2B	0.30JB	1.5B	0.65B	0.37B
Ethylbenzene	100-41-4	mg/kg	ND	ND	ND	ND	ND	ND
Chloroform	67-66-3	mg/kg	0.32B	0.53B	0.48B	0.088B	0.088B	0.10B
2-Hexanone	591-78-6	mg/kg	ND	ND	ND	ND	ND	ND
Methylene Chloride	75-09-2	mg/kg	1.1B	0.95B	1.3B	0.11B	0.12B	0.16B
Tetrachloroethylene	127-18-4	mg/kg	ND	ND	ND	ND	ND	ND
Toluene	108-88-3	mg/kg	ND	ND	ND	ND	ND	ND
Xylene, total	-	mg/kg	1.7	0.19J	0.50	0.06B	BDL	0.022JB
ACID/BASE-NEUTRAL EXTRACTABLES								
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.47J	0.27J	0.72J	BDL	0.093J	0.12J
Di-n-butyl phthalate	84-74-2	mg/kg	ND	ND	ND	ND	ND	ND
Fluoranthene	206-44-0	mg/kg	ND	ND	ND	ND	ND	ND
Isophorone	78-59-1	mg/kg	ND	ND	ND	ND	ND	ND
Naphthalene	91-20-3	mg/kg	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	mg/kg	ND	ND	ND	ND	ND	ND
Phenanthrene	85-01-8	mg/kg	ND	ND	ND	ND	ND	ND
Pyrene	129-00-0	mg/kg	BDL	ND	ND	ND	ND	ND
PESTICIDES/POLYCHLORINATED BIPHENYLS								
Endrin	72-70-8	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL
Aroclor 1248	12672-29-6	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL

[a] Samples were collected during the following dates: April 1 to April 8, 1985; November 24 and November 25, 1986 January 26 to January 28, 1987.

[b] The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

[c] "mg/kg" indicates milligrams per kilogram or parts per million (ppm).

[d] "ND" indicates not determined.

[e] "B" indicates that the corresponding, compound was found in the blank as well as the sample.

[f] "J" indicates that the corresponding compound is present, but the calculated concentration is less than the specified detection limit.

[g] Total xylenes include the ortho-, meta- and para xylene isomers. A CAS number is not available for total xylene.

[h] The indicated compound is detected as the compound in parenthesis.

[i] "BDL" indicates not detected above the U.S. Environmental Protection Agency (U.S. EPA) Contract Laboratory Program (CLP) Hazardous Substance List (HSL) Contract Required Detection Limits (CRDL).

0002229

TABLE C.5

SUMMARY OF INORGANIC AND EP TOXICITY METHOD RESULTS[a]
SLUDGE PIT AREA
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

PARAMETERS	CONCENTRATION UNITS	SLUDGE AND SOIL COMPOSITE-APR. 1985				VERTICAL TEST PIT COMPOSITES-APR. 1985					TEST PIT SAMPLES-APR. 1985				
		SLUDGE TOTAL[b]	COMPOSITE EP TOX[c]	SOIL TOTAL	COMPOSITE EP TOX	TP-1 EP TOX	TP-2 EP TOX	TP-3 EP TOX	TP-4 EP TOX	TP-5 EP TOX	TP-1 0-1 FT TOTAL	TP-2 2-3 FT TOTAL	TP-3 4-5 FT TOTAL	TP-4 4.5-6 FT TOTAL	TP-5 5-5.5 FT TOTAL
GENERAL CHEMISTRY															
pH (1:1)	pH units	8.30	ND[d]	7.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide, Amenable	ppm[e]	0.5U[f]	0.02U	0.5U	0.02U	0.02U	0.04	0.13	0.02U	0.02U	0.5U	0.5U	0.5U	75	140
Cyanide, Total	ppm	250	0.02U	8.8	0.02U	0.04	0.10	0.45	0.02	0.02	820	580	7.8	520	1 100
Fluoride	ppm	110	3.2	27	0.6	3.9	7.4	2.8	2.3	1.3	140	110	110	103	36
Nitrate	ppm	0.6	0.1	0.6	0.1U	0.2	0.1U	0.2	0.2	0.1	ND	ND	ND	ND	ND
METALS															
Aluminum	ppm	49,000	0.01U	11,000	0.93	0.13	0.01U	1.0	2.4	0.14	ND	ND	ND	ND	ND
Arsenic	ppm	37	0.01U	12	0.01U	0.01U	0.01U	0.01U	0.01U	0.02	ND	ND	ND	ND	ND
Barium	ppm	120	0.13	300	0.21	0.12	0.16	0.28	0.13	0.10	ND	ND	ND	ND	ND
Cadmium	ppm	2.0	0.01U	2.0	0.02	0.01U	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	ND	ND
Calcium	ppm	38,000	ND	2,800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	0.1U	0.01U	0.1	0.01U	0.43	0.47	0.16	0.01U	0.01U	0.1U	0.1U	0.1U	0.1U	0.1U
Chromium, Total	ppm	6,100	0.11	130	0.06	0.45	0.46	0.32	0.50	0.09	7,100	5,600	91	5,200	22,000
Copper	ppm	33	0.01	29	0.01U	0.01U	0.01U	0.01U	0.01U	0 01U	ND	ND	ND	ND	ND
Iron	ppm	12,000	0.03	23,000	0.09	0.05	0.05	0.25	0.04	0.07	6,900	16,000	34,000	16,000	5,700
Lead	ppm	40	0.18	25	0.01U	0.16	0.13	0.12	0.13	0.13	ND	ND	ND	ND	ND
Magnesium	ppm	39,000	ND	2,900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	750	1.8	980	16	0.94	0.47	3.6	6.6	1.5	370	520	1,200	550	700
Mercury	ppm	0.37	0.020	0.11	0.0002U	0.0039	0.0035	0.012	0.0022	0.0002U	ND	ND	ND	ND	ND
Selenium	ppm	0.1U	0.01U	0.1U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	ND	ND
Silicon	ppm	180	ND	260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	13	0.04	8.0	0.03	0.04	0.03	0.03	0.03	0.03	0.1U	0.1U	0.23	0.1U	0.1U
Zinc	ppm	100	0.01U	140	0.45	0.01U	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	ND	ND

See footnotes at end of table

TABLE C.5
(Continued)

PARAMETERS	CONCENTRATION UNITS	SLUDGE & SOIL COMPOSITES-JAN. 1987 SLUDGE COMPOSITE TOTAL	EP TOX	SOIL COMPOSITE TOTAL	EP TOX	SLUDGE & SOIL COMPOSITES-JAN. 1987 SLUDGE COMPOSITE TOTAL	EP TOX	SOIL COMPOSITE TOTAL	EP TOX
GENERAL CHEMISTRY									
pH (1:1)	pH units	8.2	ND	7.9	ND	8.10	ND	7.60	ND
Cyanide, Amenable	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide, Total	ppm	560	0.02	18	0.02	4,700	0.020	740	0.020
Fluoride	ppm	5,200	1.9	250	1.2	4,000	1.8	350	1.1
Nitrate	ppm	1.7	0.2	2.6	0.1	2.1	0.10	2.4	0.1
METALS									
Aluminum	ppm	50,800	0.1U	8,070	2.13	ND	ND	ND	ND
Arsenic	ppm	16	0.010	8.2	0.1U	ND	ND	ND	ND
Barium	ppm	136	0.122	130	0.146	ND	ND	ND	ND
Cadmium	ppm	4.3	0.007	1.00	0.005U	ND	ND	ND	ND
Calcium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	1.2	0.02	1.2	0.03	1.2	0.38	1.20	0.02
Chromium, Total	ppm	6,180	0.103	78	0.010	ND	ND	ND	ND
Copper	ppm	8.4	0.010	22	0.010	ND	ND	ND	ND
Iron	ppm	13,500	0.086	25,100	0.010	ND	ND	ND	ND
Lead	ppm	22	0.005U	13	0.005U	ND	ND	ND	ND
Magnesium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	564	1.26	491	12.3	ND	ND	ND	ND
Mercury	ppm	0.57	0.0002U	0.1U	0.0002U	0.43	0.0002U	0.1U	0.0002U
Selenium	ppm	1.7	0.005U	1.3	0.005U	ND	ND	ND	ND
Silicon	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	2.4	0.010	2.00	0.010	ND	ND	ND	ND
Zinc	ppm	95	0.015	80	0.053	ND	ND	ND	ND

[a]Samples were collected during the following dates: April 1 to April 8, 1985; November 17 to December 2, 1986; January 26 to January 28, 1987

[b]The indicated values represent the total concentration in milligrams per kilogram (mg/kg) or parts per million of the corresponding parameter present in sample

[c]"EP TOX" refers to EP Toxicity leachate generated by the Extraction Procedure (EP) Toxicity Text Method, SW-1310 as described in U.S. Environmental Protection Agency, 1984 "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,' SW-846, Second Edition Revised, Waste Characterization Branch, Office of Solid Waste Washington, D.C.

[d]"ND" indicates not determined

[e]The limits for total constituent analyses are reported in milligrams per kilogram (mg/kg) or parts per million (ppm). The EP Toxicity Test Method leachate analyses are reported in milligrams per liter (mg/l) or ppm.

[f]"U" indicates that the compound was analyzed but not detected. The corresponding number represents the method detection limit for the sample.

C0002231

TABLE C.6

SUMMARY OF HAZARDOUS SUBSTANCE LIS[illegible]OUND RESULTS[a]
SLUDGE PIT AREA
ALSCO – ANACONDA NPL SITE
GNADENHUTTEN, OHIO

PARAMETERS	CAS NUMBER[b]	CONCENTRATION UNITS	SLUDGE COMPOSITE APR. 1985	VERTICAL SOIL COMPOSITES JAN. 1987 S-1	S-2	S-3	S-4	S-5
VOLATILES								
Acetone	67-64-1	mg/kg[c]	ND[d]	0.44B[e]	0.72B	0.51B	0.94B	0.50B
Ethylbenzene	100-41-4	mg/kg	BDL[f]	ND	ND	ND	ND	ND
Chloroform	67-66-3	mg/kg	ND	0.17B	0.19B	0.16B	0.17B	0.19B
2-Hexanone	591-78-6	mg/kg	BDL	ND	ND	ND	ND	ND
Methylene Chloride	75-09-2	mg/kg	ND	0.21B	0.22B	0.19B	0.24B	0.35B
Tetrachloroethylene	127-18-4	mg/kg	BDL	ND	ND	ND	ND	ND
Toluene	108-88-3	mg/kg	BDL	ND	ND	ND	ND	ND
Xylene, total[g]	–[h]	mg/kg	0.012	BDL	BDL	0.066JB[h]	0.028JB	BDL
ACID/BASE-NEUTRAL EXTRACTABLES								
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	2.6	0.69J	0.92J	2.1	0.21J	0.55J
Di-n-butyl phthalate	84-74-2	mg/kg	0.35	ND	ND	ND	ND	ND
Fluoranthene	206-44-0	mg/kg	BDL	ND	ND	ND	ND	ND
Isophorone	78-59-1	mg/kg	BDL	ND	ND	ND	ND	ND
Naphthalene	91-20-3	mg/kg	BDL	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine (Diphenylamine)[i]	86-30-6	mg/kg	BDL	ND	ND	ND	ND	ND
Phenanthrene	85-01-8	mg/kg	BDL	ND	ND	ND	ND	ND
Pyrene	129-00-0	mg/kg	BDL	ND	ND	ND	ND	ND
PESTICIDES/POLYCHLORINATED BIPHENYLS								
Endrin	72-70-8	mg/kg	0.032	ND	ND	ND	ND	ND
Aroclor 1248	12672-29-6	mg/kg	BDL	ND	ND	ND	ND	ND

[a]Samples were collected during the following dates: April 1 to April 8, 1985; November 24 and November 25, 1986; January 26 to January 28, 1987.

[b]The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

[c]"mg/kg" indicates milligrams per kilogram or parts per million (ppm).

[d]"ND" indicates not determined.

[e]"B" indicates that the corresponding compound was found in the blank as well as the sample.

[f]"BDL" indicates not detected above the U.S. Environmental Protection Agency (U.S. EPA) Contract Laboratory Program (CLP) Hazardous Substance List (HSL) Contract Required Detection Limits (CRDL).

[g]Total xylenes include the ortho-, meta-, and para-xylene isomers. A CAS number is not available for total xylene.

[h]"J" indicates that the corresponding compound is present, but the calculated concentration is less than the specified detection limits.

[i]The indicated compound is detected as the compound in parenthesis.

TABLE C.7

SUMMARY OF INORGANIC AND E. P. TOXICITY
SWAMP AREA
ALSCO-ANACONDO NPL SITE
GNADENHITTEN OHIO

PARAMETERS	CONCENTRATION UNITS	SLUDGE AND SOIL COMPOSITE-APR 1985				AREA NO 1 COMPOSITE-NOV 1986				AREA NO 2 COMPOSITE-NOV 1986			
		SLUDGE COMPOSITE		SOIL COMPOSITE		SLUDGE COMPOSITE		SOIL COMPOSITE		SLUDGE COMPOSITE		SOIL COMPOSITE	
		TOTAL[b]	E P TOX[c]	TOTAL	E P TOX	TOTAL	E P TOX	TOTAL	E P TOX	TOTAL	E P TOX	TOTAL	E P TO
GENERAL CHEMISTRY													
pH (1:1)	pH units	8.20	ND[d]	7.00	ND	8.15	ND	7.10	ND	8.00	ND	7.00	ND
Cyanide, Amenable	ppm[e]	0.5U[f]	0.02U	0.5U	0.02U	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide, Total	ppm	520	0.02U	9.8	0.02U	670	0.02U	17	0.02U	120	0.02U	20	0.04
Fluoride	ppm	110	2.1	59	1.1	6,700	2.3	340	1.6	13,000	2.9	310	1.8
Nitrate	ppm	1.4	0.4	1.0	0.1	2.3	0.1U	2.2	0 2	8.9	0.3	5.5	0.2
METALS													
Aluminum	ppm	57,000	0.07	18,000	3.2	72 000	0.2	16 000	2.6	70,000	0.7	17,000	3.5
Arsenic	ppm	41	0.01U	22	0.01U	4.5	0.01U	16	0.01U	31	0.01U	21	0.01U
Barium	ppm	210	0.33	170	0.46	180	0.28	170	0.18	190	0 26	210	0.14
Cadmium	ppm	4.0	0.01U	2.0	0.02	6.8	0.006	1.0U	0.005U	6.8	0.008	1.0U	0.005U
Calcium	ppm	49,000	ND	4,000	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	0.1	0.01U	0.1U	0.01U	4.2U	0.02	1.6J[g]	0.01U	0.20J	0.11	13	0.01U
Chromium, Total	ppm	14,000	0.13	340	0.10	17 000	1.7	660	0.03	17,000	1.9	450	0.02
Copper	ppm	36	0.01	41	0.01U	21	0.01	4.4	0.01U	24	0.01U	53	0.01U
Iron	ppm	19,000	0.03	42 000	0.01U	18,000	0.48	41,000	0.05	17,000	0.42	48,000	0.05
Lead	ppm	93	0.18	62	0.01U	87	0.005U	63	0.005U	88	0.005U	73	0.005U
Magnesium	ppm	[illegible]	ND	3,700	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	[illegible]	[illegible]	1,100	9.8	870	3.0	1,200	5.4	960	3.3	900	4.4
Mercury	ppm	[illegible]	[illegible]	0.22	0.0002U	0.96	0.0004U	0.82	0.0002U	0.87	0.0002U	0.84	0.0002
Selenium	ppm	[illegible]	[illegible]	0.1U	0.01U	2.3	0.005U	1.0U	0.005U	1.0U	0.005U	1.0U	0.005U
Silicon	ppm	420	ND	240	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE C.3

SUMMARY OF GENERAL-INORGANIC AND EP TOXICITY METHOD RESULTS[a]
SOUTHERN IMPOUNDMENT AREA
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

PARAMETERS	CONCENTRATION UNITS	SLUDGE COMPOSITES-APR 1985 TOTAL[b]	SLUDGE COMPOSITES-APR 1985 EP TOX[c]	TEST PIT VERTICAL COMPOSITES-APR. 1985					TEST PIT SAMPLES-APR. 1985						
				TP-9 EP TOX	TP-10 EP TOX	TP-11 EP TOX	TP-12 EP TOX	TP-13 EP TOX	TP-9 2.5 FT	TP-9 3 FT	TP-10 1.5 FT	TP-10 6 FT	TP-11 1-3 FT	TP-12 1-2 FT	TP-13 3 FT
GENERAL CHEMISTRY															
pH (1:1)	pH units	9.05	ND[d]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ajanide, Amenable	ppm[e]	0.5U[f]	0.06	0.02U	0.02U	0.02U	0.02U	0.02	0.5U	3 2	0.5U	0.5U	0.5U	820	0.5U
Ajanide, Total	ppm	320	0.06	0.02	0.02	0.04	0.02U	0.16	22	8.0	1,500	0.8	660	890	210
Fluoride	ppm	84	11	0.9	2.5	12	14	3.5	120	35	12	21	100	12	18
Nitrate	ppm	0.3	0.10	0.10	0.20	0.7	0.2	4.6	ND	ND	ND	ND	ND	ND	ND
METALS															
Aluminum	ppm	22,000	0.01	47	7.4	0.010	0.010	1.3	ND	ND	ND	ND	ND	ND	ND
Arsenic	ppm	14	0.010	0.010	0.010	0.010	0.010	0.01U	ND	ND	ND	ND	ND	ND	ND
Barium	ppm	75	0.18	0.78	0.36	0.13	0.14	0.07	ND	ND	ND	ND	ND	ND	ND
Cadmium	ppm	2.0	0.010	0.010	0.010	0.010	0.010	0.02	ND	ND	ND	ND	ND	ND	ND
Calcium	ppm	27,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	0.10	0.010	0.010	0.010	0.12	0.01	0.04	0.10	0.6	0.10	0.10	0.10	0.10	0.10
Chromium, Total	ppm	4,200	0.09	11	1.7	0.15	0.11	0.13	30	240	9,800	33	5,500	8,400	2,200
Copper	ppm	12	0.010	0.010	0.010	0.010	0.010	0.05	ND	ND	ND	ND	ND	ND	ND
Iron	ppm	10,000	0.01	40	0.66	0.01	0.010	0.18	29,000	9,700	1,800	24,000	3,100	1,700	1,900
Lead	ppm	170	0.12	0.56	0.13	0.09	0.14	0.37	ND	ND	ND	ND	ND	ND	ND
Magnesium	ppm	47,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	610	0.50	22	8.8	0.03	0.06	0.08	1,000	250	270	790	230	180	120
Mercury	ppm	18	0.0056	0.011	0.0002U	0.0025	0.0002U	0.016	ND	ND	ND	ND	ND	ND	ND
Selenium	ppm	0.10	0.010	0.010	0.010	0.010	0.010	0.010	ND	ND	ND	ND	ND	ND	ND
Silicon	ppm	300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	4.0	0.03	0.16	0.04	0.02	0.03	0.07	0.10	0.23	0.10	0.10	0.10	0.10	0.10
Zinc	ppm	980	0.010	1.2	0.03	0.010	0.010	0.010	ND	ND	ND	ND	ND	ND	ND

See footnotes at end of table

0002234

TABLE C.3
(Continued)

PARAMETERS	CONCENTRATION UNITS	SLUDGE COMPOSITE & SOIL SAMPLE-NOV. 1987: SLUDGE COMPOSITE		S-4 SOIL 6.0-8.0 FT		S-5 SOIL 9.5-11.0 FT		S-6 SOIL 10.1-11.4 FT		SLUDGE COMPOSITE SAMPLE-JAN. 1987: SLUDGE COMPOSITE		S-4 SOIL 8.0-9.0 FT		S-5 SOIL 8.5-9.0 FT		S-6 SOIL 9.5-10.1 FT	
		TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX	TOTAL	EP TOX
GENERAL CHEMISTRY																	
pH (1:1)	pH units	8.4	ND	8.3	ND	8.2	ND	8.6	ND	8.90	ND	7.75	ND	8.50	ND	8.60	ND
Cyanide, Amenable	ppm[e]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide Total	ppm	490	0.02	1.6	1.02	18	0.02	25	0.02	440	0.020U	170	0.020U	35	0.020U	120	0.020U
Fluoride	ppm	3,400	6.1	58	0.02	190	0.02	310	1.1	2,300	4.5	160	1.1	290	0.9	570	0.6
Nitrate	ppm	1.8	0.1	1.2	0.4	1.2	0.3	4.6	0.4	1.80	0.10	1.30	0.10	1.20	0.10	1.30	0.10
METALS																	
Aluminum	ppm	34,600	0.245	8,240	0.161	6,460	1.62	5,560	2.72	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	ppm	20	0.005U	7.1	0.005U	10U	0.005U	7.5	0.005U	ND	ND	ND	ND	ND	ND	ND	ND
Barium	ppm	32	0.82	11.3	0.273	64	0.258	32	0.184	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	ppm	4.7	0.014	1.0U	0.005U	1.0U	0.005U	1.0U	0.005U	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	ppm	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	4.4	0.01	3.6	0.01	3.0	0.01	1.3	0.01	1.80	0.03	3.60	0.010	3.00	0.010	1.30	0.010
Chromium, Total	ppm	5,760	0.012	19	0.012	212	0.022	410	0.044	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ppm	2.6	0.023	15	0.010	48	0.012	61	0.024	ND	ND	ND	ND	ND	ND	ND	ND
Iron	ppm	2,410	0.119	24,300	2.0	30,300	20.7	31,100	47.9	ND	ND	ND	ND	ND	ND	ND	ND
Lead	ppm	15	0.005U	13	0.005U	13	0.005U	8.3	0.005U	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	ppm	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	217	0.70	764	9.49	365	2.32	308	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	ppm	0.58	0.002U	0.71	0.0002U	0.5	0.0002U	0.41	0.0002U	1.3	0.0003	0.12	0.0002U	0.29	0.0002U	0.27	0.0002
Selenium	ppm	1.6	0.132	1.4	0.016	1.1	0.019	1.3	0.027	ND	ND	ND	ND	ND	ND	ND	ND
Silicon	ppm	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	2.1	0.025	2.0U	0.01	2.0U	0.01U	2.0U	0.017	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ppm	754	0.028	56	0.013	62	0.093	62	0.171	ND	ND	ND	ND	ND	ND	ND	ND

[a]Samples were collected during the following dates: April 1 to April 8, 1985, November 17 to December 2, 1986; January 26 to January 28, 1987.

[b]The indicated values represent the total concentration in milligrams per kilogram (mg/kg) or parts per million of the corresponding parameter present in sample.

[c]"EP TOX" refers to EP Toxicity leachate generated by the Extraction Procedure (EP) Toxicity Text Method, SW-1310 as described in U.S. Environmental Protection Agency, 1984, "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," SW-846, Second Edition Revised, Waste Characterization Branch Office of Solid Waste Washington D.C.

[d]"ND" indicates not determined

[e]The limits for total constituent analyses are reported in milligrams per kilogram (mg/kg) or parts per million (ppm). The EP Toxicity Test Method leachate analyses are reported in milligrams per liter (mg/l) or ppm.

[f]"U" indicates that the compound was analyzed but not detected. The corresponding number represents the method detection limit for the sample.

0002235

TABLE C.4

SUMMARY OF HAZARDOUS SUBSTANCE LIST COMPOUND RESULTS[a]
SOUTHERN IMPOUNDMENT AREA
ALSCO - ANACONDA NPL SITE
GNADENHUTTEN, OHIO

PARAMETERS	CAS NUMBER[b]	CONCENTRATION UNITS	SLUDGE COMPOSITE APR. 1985	SLUDGE COMPOSITE NOV. 1986	S-4 SLUDGE COMPOSITE NOV. 1986	S-5 SLUDGE COMPOSITE NOV. 1986	S-6 SLUDGE COMPOSITE NOV. 1986	S-4 SOIL 6.0-8.0 FT NOV. 1986	S-5 SOIL 9.5-11 FT NOV. 1986	S-6 SOIL 10.1-11.4 FT NOV. 1986
VOLATILES										
Acetone	67-64-1	mg/kg[c]	ND[d]	0.48B[e]	ND	ND	ND	0.077J[f]B	0.20B	0.12B
Ethylbenzene	100-41-4	mg/kg	110	ND	ND	ND	ND	ND	ND	ND
Chloroform	67-66-3	mg/kg	ND	0.29B	ND	ND	ND	0.072JB	0.035JB	0.034JB
2-Hexanone	591-78-6	mg/kg	43	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	75-09-2	mg/kg	ND	0.78B	ND	ND	ND	0.25B	0.025JB	0.021JB
Tetrachloroethylene	127-18-4	mg/kg	0.28	ND	ND	ND	ND	ND	ND	ND
Toluene	108-88-3	mg/kg	5.3	ND	ND	ND	ND	ND	ND	ND
Xylene, Total[g]	-	mg/kg	410	0.88B	ND	ND	ND	0.062JB	0.015J	0.018J
ACID/BASE-NEUTRAL EXTRACTABLES										
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	1.1	ND	BDL[h]	BDL	BDL	BDL	BDL	BDL
Di-n-butyl phthalate	84-74-2	mg/kg	0.80	ND	BDL	BDL	BDL	BDL	BDL	BDL
Fluoranthene	206-44-0	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	BDL	BDL
Isophosone	78-59-1	mg/kg	16	ND	BDL	BDL	BDL	BDL	BDL	BDL
Naphthalene	91-20-3	mg/kg	200	ND	BDL	BDL	BDL	BDL	BDL	BDL
N-Nitrosodiphenylamine (Diphenylamine)[i]	86-30-6	mg/kg	0.45	ND	BDL	BDL	BDL	BDL	BDL	BDL
Phenanthrene	85-01-8	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	BDL	BDL
Pyrene	129-00-0	mg/kg	BDL	ND	BDL	BDL	BDL	BDL	BDL	BDL
PESTICIDES/POLYCHLORINATED BIPHENYLS										
Endrin	72-20-8	mg/kg	0.066	ND	ND	ND	ND	ND	ND	ND
Aroclor 1248	12672-29-6	mg/kg	BDL	ND	ND	ND	ND	ND	ND	ND

See footnotes at end of table

000002236

TABLE
(Conti

PARAMETERS	CAS NUMBER	CONCENTRATION UNITS	S-4 VERTICAL COMPOSITE JAN. 1987	S-5 VERTICAL COMPOSITE JAN. 1987	S-6 VERTICAL COMPOSITE JAN. 1986	S-4 SOIL 8.0-9.0 FT JAN. 1987	S-5 SOIL 8.5-9.0 FT JAN. 1987	S-6 SOIL 9.5-10.1 FT JAN. 1987
VOLATILES								
Acetone	67-64-1	mg/kg	0.28JB	1.2B	0.30JB	1.5B	0.65B	0.37B
Ethylbenzene	100-41-4	mg/kg	ND	ND	ND	ND	ND	ND
Chloroform	67-66-3	mg/kg	0.32B	0.53B	0.48B	0.088B	0.088B	0.10B
2-Hexanone	591-78-6	mg/kg	ND	ND	ND	ND	ND	ND
Methylene Chloride	75-09-2	mg/kg	1.1B	0.95B	1.3B	0.11B	0.12B	0.16B
Tetrachloroethylene	127-18-4	mg/kg	ND	ND	ND	ND	ND	ND
Toluene	108-88-3	mg/kg	ND	ND	ND	ND	ND	ND
Xylene, total	-	mg/kg	1.7	0.19J	0.50	0.06B	BDL	0.022JB
ACID/BASE-NEUTRAL EXTRACTABLES								
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.47J	0.27J	0.72J	BDL	0.093J	0.12J
Di-n-butyl phthalate	84-74-2	mg/kg	ND	ND	ND	ND	ND	ND
Fluoranthene	206-44-0	mg/kg	ND	ND	ND	ND	ND	ND
Isophorone	78-59-1	mg/kg	ND	ND	ND	ND	ND	ND
Naphthalene	91-20-3	mg/kg	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	mg/kg	ND	ND	ND	ND	ND	ND
Phenanthrene	85-01-8	mg/kg	ND	ND	ND	ND	ND	ND
Pyrene	129-00-0	mg/kg	BDL	ND	ND	ND	ND	ND
PESTICIDES/POLYCHLORINATED BIPHENYLS								
Endrin	72-70-8	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL
Aroclor 1248	12672-29-6	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL

[a] Samples were collected during the following dates: April 1 to April 8, 1985; November 24 and November 25, 1986 January 26 to January 28, 1987.

[b] The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

[c] "mg/kg" indicates milligrams per kilogram or parts per million (ppm).

[d] "ND" indicates not determined.

[e] "B" indicates that the corresponding compound was found in the blank as well as the sample.

[f] "J" indicates that the corresponding compound is present, but the calculated concentration is less than the specified detection limit.

[g] Total xylenes include the ortho, meta and para xylene isomers. A CAS number is not available for total xylene.

[h] The indicated compound is detected as the compound in parenthesis.

[i] "BDL" indicates not detected above the U.S. Environmental Protection Agency (U.S. EPA) Contract Laboratory Program (CLP) Hazardous Substance List (HSL) Contract Required Detection Limits (CRDL).

C002237

TABLE C.5

SUMMARY OF INORGANIC AND EP TOXICITY METHOD RESULTS[a]
SLUDGE PIT AREA
ALSCO-ANACONDA NPL SITE
GNADENHUTTEN, OHIO

PARAMETERS	CONCENTRATION UNITS	SLUDGE AND SOIL COMPOSITE-APR. 1985 SLUDGE COMPOSITE TOTAL[b]	SLUDGE COMPOSITE EP TOX[c]	SOIL COMPOSITE TOTAL	SOIL COMPOSITE EP TOX	VERTICAL TEST PIT COMPOSITES-APR. 1985 TP-1 EP TOX	TP-2 EP TOX	TP-3 EP TOX	TP-4 EP TOX	TP-5 EP TOX	TEST PIT SAMPLES-APR. 1985 TP-1 0-1 FT TOTAL	TP-2 2-3 FT TOTAL	TP-3 4-5 FT TOTAL	TP-4 4.5-6 FT TOTAL	TP-5 5-5.5 FT TOTAL
GENERAL CHEMISTRY															
pH (1.1)	pH units	8.30	ND[d]	7.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide, Amenable	ppm[e]	0.5U[f]	0.02U	0.5U	0.02U	0.02U	0.04	0.13	0.02U	0.02U	0.5U	0.5U	0.5U	75	140
Cyanide, Total	ppm	250	0.02U	8.8	0.02U	0.04	0.10	0.45	0.02	0.02	820	580	7.8	520	1 100
Fluoride	ppm	110	3.2	27	0.6	3.9	7.4	2.8	2.3	1.3	140	110	110	103	36
Nitrate	ppm	0.6	0.1	0.6	0.1U	0.2	0.1U	0.2	0.2	0.1	ND	ND	ND	ND	ND
METALS															
Aluminum	ppm	49,000	0.01U	11,000	0.93	0.13	0.01U	1.0	2.4	0.14	ND	ND	ND	ND	ND
Arsenic	ppm	37	0.01U	12	0.01U	0.01U	0.01U	0.01U	0.01U	0.02	ND	ND	ND	ND	ND
Barium	ppm	120	0.13	300	0.21	0.12	0.16	0.28	0.13	0.10	ND	ND	ND	ND	ND
Cadmium	ppm	2.0	0.01U	2.0	0.02	0.01U	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	ND	ND
Calcium	ppm	38,000	ND	2,800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	0.1U	0.01U	0.1	0.01U	0.43	0.47	0.16	0.01U	0.01U	0.1U	0.1U	0.1U	0.1U	0.1U
Chromium, Total	ppm	6,100	0.11	130	0.06	0.45	0.46	0.32	0.50	0.09	7,100	5,600	91	5,200	22,000
Copper	ppm	33	0.01	29	0.01U	0.01U	0.01U	0.01U	0.01U	0 01U	ND	ND	ND	ND	ND
Iron	ppm	12,000	0.03	23,000	0.09	0.05	0.05	0.25	0.04	0.07	6,900	16,000	34,000	16,000	5,700
Lead	ppm	40	0.18	25	0.01U	0.16	0.13	0.12	0.13	0.13	ND	ND	ND	ND	ND
Magnesium	ppm	39,000	ND	2,900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	750	1.8	980	16	0.94	0.47	3.6	6.6	1.5	370	520	1,200	550	700
Mercury	ppm	0.37	0.020	0.11	0.0002U	0.0039	0.0035	0.012	0.0022	0.0002U	ND	ND	ND	ND	ND
Selenium	ppm	0.1U	0.01U	0.1U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	ND	ND
Silicon	ppm	180	ND	260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	13	0.04	8.0	0.03	0.04	0.03	0.03	0.03	0.03	0.1U	0.1U	0.23	0.1U	0.1U
Zinc	ppm	100	0.01U	140	0.45	0.01U	0.01U	0.01U	0.01U	0.01U	ND	ND	ND	ND	ND

See footnotes at end of table

TABLE C.5
(Continued)

PARAMETERS	CONCENTRATION UNITS	SLUDGE & SOIL COMPOSITES-JAN. 1987 SLUDGE COMPOSITE TOTAL	EP TOX	SOIL COMPOSITE TOTAL	EP TOX	SLUDGE & SOIL COMPOSITES-JAN. 1987 SLUDGE COMPOSITE TOTAL	EP TOX	SOIL COMPOSITE TOTAL	EP TOX
GENERAL CHEMISTRY									
pH (1:1)	pH units	8.2	ND	7.9	ND	8.10	ND	7.60	ND
Cyanide, Amenable	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide, Total	ppm	560	0.02	18	0.02	4,700	0.020	740	0.020
Fluoride	ppm	5,200	1.9	250	1.2	4,000	1.8	350	1.1
Nitrate	ppm	1.7	0.2	2.6	0.1	2.1	0.10	2.4	0.1
METALS									
Aluminum	ppm	50,800	0.10	8,070	2.13	ND	ND	ND	ND
Arsenic	ppm	16	0.010	8.2	0.10	ND	ND	ND	ND
Barium	ppm	136	0.122	130	0.146	ND	ND	ND	ND
Cadmium	ppm	4.3	0.007	1.00	0.005U	ND	ND	ND	ND
Calcium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	1.2	0.02	1.2	0.03	1.2	0.38	1.20	0.02
Chromium, Total	ppm	6,180	0.103	78	0.010	ND	ND	ND	ND
Copper	ppm	8.4	0.010	22	0.010	ND	ND	ND	ND
Iron	ppm	13,500	0.086	25,100	0.010	ND	ND	ND	ND
Lead	ppm	22	0.005U	13	0.005U	ND	ND	ND	ND
Magnesium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	564	1.26	491	12.3	ND	ND	ND	ND
Mercury	ppm	0.57	0.0002U	0.1U	0.0002U	0.43	0.0002U	0.1U	0.0002U
Selenium	ppm	1.7	0.005U	1.3	0.005U	ND	ND	ND	ND
Silicon	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	2.4	0.010	2.00	0.010	ND	ND	ND	ND
Zinc	ppm	95	0.015	80	0.053	ND	ND	ND	ND

[a]Samples were collected during the following dates: April 1 to April 8, 1985; November 17 to December 2, 1986; January 26 to January 28, 1987

[b]The indicated values represent the total concentration in milligrams per kilogram (mg/kg) or parts per million of the corresponding parameter present in sample

[c]"EP TOX" refers to EP Toxicity leachate generated by the Extraction Procedure (EP) Toxicity Text Method, SW-1110 as described in U.S. Environmental Protection Agency, 1984 "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," SW-846, Second Edition Revised, Waste Characterization Branch, Office of Solid Waste Washington, D.C.

[d]"ND" indicates not determined

[e]The limits for total constituent analyses are reported in milligrams per kilogram (mg/kg) or parts per million (ppm). The EP Toxicity Test Method leachate analyses are reported in milligrams per liter (mg/l) or ppm.

[f]"U" indicates that the compound was analyzed but not detected. The corresponding number represents the method detection limit for the sample.

00022230

TABLE C.6

SUMMARY OF HAZARDOUS SUBSTANCE LIS[illegible] [illegible]OUND RESULTS[a]
SLUDGE PIT AREA
ALSCO - ANACONDA NPL SITE
GNADENHUTTEN, OHIO

PARAMETERS	CAS NUMBER[b]	CONCENTRATION UNITS	SLUDGE COMPOSITE APR. 1985	VERTICAL SOIL COMPOSITES JAN. 1987 S-1	S-2	S-3	S-4	S-5
VOLATILES								
Acetone	67-64-1	mg/kg[c]	ND[d]	0.44B[e]	0.72B	0.51B	0.94B	0.50B
Ethylbenzene	100-41-4	mg/kg	BDL[f]	ND	ND	ND	ND	ND
Chloroform	67-66-3	mg/kg	ND	0.17B	0.19B	0.16B	0.17B	0.19B
2-Hexanone	591-78-6	mg/kg	BDL	ND	ND	ND	ND	ND
Methylene Chloride	75-09-2	mg/kg	ND	0.21B	0.22B	0.19B	0.24B	0.35B
Tetrachloroethylene	127-18-4	mg/kg	BDL	ND	ND	ND	ND	ND
Toluene	108-88-3	mg/kg	BDL	ND	ND	ND	ND	ND
Xylene, total[g]	-[h]	mg/kg	0.012	BDL	BDL	0.066JB[h]	0.028JB	BDL
ACID/BASE-NEUTRAL EXTRACTABLES								
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	2.6	0.69J	0.92J	2.1	0.21J	0.55J
Di-n-butyl phthalate	84-74-2	mg/kg	0.35	ND	ND	ND	ND	ND
Fluoranthene	206-44-0	mg/kg	BDL	ND	ND	ND	ND	ND
Isophorone	78-59-1	mg/kg	BDL	ND	ND	ND	ND	ND
Naphthalene	91-20-3	mg/kg	BDL	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine (Diphenylamine)[i]	86-30-6	mg/kg	BDL	ND	ND	ND	ND	ND
Phenanthrene	85-01-8	mg/kg	BDL	ND	ND	ND	ND	ND
Pyrene	129-00-0	mg/kg	BDL	ND	ND	ND	ND	ND
PESTICIDES/POLYCHLORINATED BIPHENYLS								
Endrin	72-70-8	mg/kg	0.032	ND	ND	ND	ND	ND
Aroclor 1248	12672-29-6	mg/kg	BDL	ND	ND	ND	ND	ND

[a]Samples were collected during the following dates: April 1 to April 8, 1985, November 24 and November 25, 1986; January 26 to January 28, 1987.

[b]The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

[c]"mg/kg" indicates milligrams per kilogram or parts per million (ppm).

[d]"ND" indicates not determined.

[e]"B" indicates that the corresponding compound was found in the blank as well as the sample.

[f]"BDL" indicates not detected above the U.S. Environmental Protection Agency (U.S. EPA) Contract Laboratory Program (CLP) Hazardous Substance List (HSL) Contract Required Detection Limits (CRDL).

[g]Total xylenes include the ortho-, meta- and para-xylene isomers. A CAS number is not available for total xylene.

[h]"J" indicates that the corresponding compound is present, but the calculated concentration is less than the specified detection limits.

[i]The indicated compound is detected as the compound in parenthesis.

00002240

TABLE C.7
(Continued)

PARAMETERS	CONCENTRATION UNITS	AREA NO 5 COMPOSITE-NOV 1986				AREA NO 1 COMPOSITE-JAN 1987				AREA NO 2 COMPOSITE-JAN 1987			
		SLUDGE COMPOSITE		SOIL COMPOSITE		SLUDGE COMPOSITE		SOIL COMPOSITE		SLUDGE COMPOSITE		SOIL COMPOSITE	
		TOTAL	E P TOX	TOTAL	E P TOX	TOTAL	E P TOX	TOTAL	E P TOX	TOTAL	E P TOX	TOTAL	E P TOX
GENERAL CHEMISTRY													
pH (1:1)	pH units	7.70	ND	7.10	ND	8.25	ND	7.35	ND	8.05	ND	7.40	ND
Cyanide, Amenable	ppm"	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide, Total	ppm	42	0.24	11	0.02U	800	0.02U	27	0.03	630	0.02U	63	0.02U
Fluoride	ppm	4,60(	1.6	150	0.6	7,900	2.1	440	1.7	12,000	2.1	560	2.5
Nitrate	ppm	1.9	0.1U	5.8	0.2	10	0.3	5.0	0.3	6.9	0.3	5.4	0.4
METALS													
Aluminum	ppm	36,0(0	0.2	12,000	1.5	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	ppm	35	0.04	18	0.01U	ND	ND	ND	ND	ND	ND	ND	ND
Barium	ppm	240	0.008	130	0.33	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	ppm	3.6	0.006	1.0U	0.009	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	ppm	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	0.63!	0.01U	6.4U	0.14	1.7U	0.54	3.2U	0.01U	1.7U	0.19	3.4U	0.01U
Chromium, Total	ppm	14,0(0	0.18	380	0.03	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ppm	44	0.01U	47	0.01U	ND	ND	ND	ND	ND	ND	ND	ND
Iron	ppm	20,0(0	0.08	39,000	0.04	ND	ND	ND	ND	ND	ND	ND	ND
Lead	ppm	120	0.006	71	0.006	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	ppm	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	5,60(	23	1,600	13	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	ppm	0.80	0.0002U	0.99	0.0002U	0.65	0.0002U	0.31	0.0002U	0.19	0.0002U	0.32	0.0002U
Selenium	ppm	25	0.011	1.0U	0.005U	ND	ND	ND	ND	ND	ND	ND	ND
Silicon	ppm	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	2.9	0.01	2.0U	0.01U	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ppm	4,70(	2.6	350	0.90	ND	ND	ND	ND	ND	ND	ND	ND

PARAMETERS	CONCENTRATION UNITS	AREA NO 3 COMPOSITE-JAN 1987				AREA NO 4 COMPOSITE-JAN 1987			
		SLUDGE COMPOSITE		SOIL COMPOSITE		SLUDGE COMPOSITE		SOIL COMPOSITE	
		TOTAL	E P TOX	TOTAL	E P TOX	TOTAL	E P TOX	TOTAL	E P TOX
GENERAL CHEMISTRY									
pH (1:1)	pH units	7.85	ND	7.40	ND	7.80	ND	7.45	ND
Cyanide, Amenable	ppm"	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide, Total	ppm	350	0.10	21	0.02U	360	0.02U	21	0.02U
Fluoride	ppm	3,300	1.3	350	0.9	2,400	0.5	170	0.4
Nitrate	ppm	1.6	0.1U	11	0.2	1.7U	0.1U	1.3U	0.1U
METALS									
Aluminum	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Barium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent	ppm	1.6U	0.03	1.8U	0.16	1.7U	0.04	1.3U	0.01U
Chromium, Total	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Iron	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Lead	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	ppm	0.25	0.0002U	0.14	0.0002U	0.39	0.0002U	0.56	0.0002U
Selenium	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Silicon	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ppm	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ppm	ND	ND	ND	ND	ND	ND	ND	ND

See footnotes at end of table

TABLE C.7
(Continued)

PARAMETERS	CONCENTRATION UNITS	AREA NO 5 COMPOSITE-JAN 1987 SLUDGE COMPOSITE TOTAL	E P TOX	SOIL COMPOSITE TOTAL	E P TOX
GENERAL CHEMISTRY					
pH (1:1)	pH units	7.95	ND	7.30	ND
Cyanide, Amenable	ppm[e]	ND	ND	ND	ND
Cyanide, Total	ppm	77	0.02U	7.5	0.02U
Fluoride	ppm	7,100	1.7	120	0.5
Nitrate	ppm	1.8U	0.1U	1.3U	0.1U
METALS					
Aluminum	ppm	ND	ND	ND	ND
Arsenic	ppm	ND	ND	ND	ND
Barium	ppm	ND	ND	ND	ND
Cadmium	ppm	ND	ND	ND	ND
Calcium	ppm	ND	ND	ND	ND
Chromium, Hexavalent	ppm	1.8U	0.01U	1.3U	0.06
Chromium, Total	ppm	ND	ND	ND	ND
Copper	ppm	ND	ND	ND	ND
Iron	ppm	ND	ND	ND	ND
Lead	ppm	ND	ND	ND	ND
Magnesium	ppm	ND	ND	ND	ND
Manganese	ppm	ND	ND	ND	ND
Mercury	ppm	0.45	0.0002U	0.99	0.0002U
Selenium	ppm	ND	ND	ND	ND
Silicon	ppm	ND	ND	ND	ND
Silver	ppm	ND	ND	ND	ND
Zinc	ppm	ND	ND	ND	ND

[a] Samples were collected during the following dates: April 1 to April 8, 1985; November 17 to December 2, 1986; January 26 to January 28, 1987

[b] The indicated values represent the total concentration in milligrams per kilogram (mg/kg) or parts per million of the corresponding parameter present in sample

[c] "E P TOX" refers to E. P. Toxicity leachate generated by the Extraction Procedure (EP) Toxicity Text Method, SW-1310 as described in U.S. Environmental Protection Agency, 1984, "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," SW-846, Second Edition Revised, Waste Characterization Branch, Office of Solid Waste, Washington, D.C.

[d] "ND" indicates not determined

[e] The limit for total constituent analysis are reported in milligrams per kilogram (mg/kg) or parts per million (ppm). The EP Toxicity Test Method leachate analysis are reported in milligrams per liter (mg/l) or ppm.

[f] "U" indicates that the compound was analyzed but not detected. The corresponding number represents the method detection limit for the sample.

TABLE C.8

SUMMARY OF HAZARDOUS SUBSTANCE LIST COMPOUND RESULTS[a]
SWAMP AREA
ALSCO - ANACONDA NPL SITE
GNADENHUTTEN, OHIO

PARAMETERS	CAS NUMBERS[b]	CONCENTRATION UNITS	SLUDGE COMPOSITE APR 1985	SOIL COMPOSITE APR 1985
VOLATILES:				
Ethybenzene	100-41-4	mg/kg[c]	BDL[d]	BDL
2-Hexanone	591-78-6	mg/kg	BDL	BDL
Tetrachloroethylene	127-18-4	mg/kg	BDL	BDL
Tolune	108-88-3	mg/kg	BDL	BDL
Xylene, total[e]	-	mg/kg	BDL	BDL
ACID/BASE-NEUTRAL EXTRACTABLES:				
Bis (2-ethylhexyl) phthalate	117-81-7	mg/kg	2.9	0.75
Di-n-butyl phthalate	84-74-2	mg/kg	0.52	BDL
Fluoranthene	206-74-2	BDL	BDL	0.51
Isophosone	78-59-1	mg/kg	BDL	BDL
Naphthalene	91-20-3	mg/kg	BDL	BDL
N-Nitrosodiphenylamine (Diphenylamine)[f]	86-30-6	mg/kg	0.67	BDL
Phenanthrene	85-01-8	mg/kg	BDL	0.38
Pyrene	129-00-0	mg/kg	0.38	0.66
PESTICIDES/POLYCHLORINATED BIPHENYLS:				
Endrin	72-70-8	mg/kg	BDL	BDL
Aroclor 1248	12672-29-6	mg/kg	1.2	30

[a]Samples were collected during the following dates: April 1 to April 8, 1985; November 24 and November 25, 1986; January 26 and January 28, 1987.

[b]The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

[c]"mg/kg" indicates milligrams per kilogram or parts per million (ppm).

[d]"BDL" indicates not detected above the U.S. Environmental Protection Agency (EPA) Contract Laboratory (CLP) Hazardous Substance List (HSL) Contract Required Detection Limits (CRDL).

[e]Total xylenes include the ortho-, meta, and para-xylene isomers. A CAS number is not available for total xylene.

[f]The indicated compound is detected as the compound in parenthesis.

TABLE C.9

SUMMARY OF POLYCHLORINATED BIPHENYL RESULTS
APRIL 1985 SWAMP AREA SLUDGES AND SOILS (a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN, OHIO

SAMPLE IDENTIFICATION(b) GRID COORDINATES OLD	NEW	DEPTH INTERVAL	WATER CONTENT (%)	POLYLCHLORINATED BIPHENYLS mg/kg(c)	Source Aroclor(d)
B-0,2	F-10	0-6"	ND(e)	1.2	1248
B-0,2	F-10	50-56"	ND	1.0U(f)	--(g)
B-0,3	H-10	0-12"	81.8	460	1248
B-0,3	H-10	48"	ND	1.2	1248
B-1,1	F-8	30-36"	ND	1.4	1248
B-1,1	F-8	72"	ND	1.0U	--
B-1,2	F-8	0-6"	ND	<1.0U	--
B-1,2	F-8	30-36"	ND	<1.0U	--
B-1,3	H-8	0-6"	81.1	180	1248
B-1,3	H-8	9-15"	ND	16	1242
B-1,4	J-8	0-6"	ND	18	1248+1254
B-1,4	J-8	6-12"	ND	1.6	1254
B-2,0	B-6	0-6"	ND	2.5	1248
B-2,1	D-6	0-6"	ND	1.0U	--
B-2,1	D-6	18-24"	ND	1.0U	--
B-2,2	F-6	0-1"	ND	1.0U	--
B-2,2	F-6	30"	ND	1.0U	--
B-2,3	H-6	0-6"	ND	146	1248+1254
B-2,3	H-6	24-30"	ND	6.7	1248
B-2,4	J-6	0-6"	ND	670	1248+1254
B-2,4	J-6	12-18"	ND	7.4	1248+1254
B-3,0	B-4	0-6"	ND	1.0U	--
B-3,0	B-4	22-24"	ND	1.0U	--
B-3,1	D-4	0-5"	ND	1.0U	--
B-3,1	D-4	5-11"	ND	1.0U	--
B-3,2	F-4	0-4"	ND	1.0U	--
B-3,2	F-4	4-10"	ND	1.0U	--

TABLE C.9
(Continued)

SAMPLE IDENTIFICATION(b) GRID COORDINATES OLD	NEW	DEPTH INTERVAL	WATER CONTENT (%)	POLYCHLORINATED BIPHENYLS mg/kg(c)	Source Aroclor(d)
B-3,3	H-4	0-6"	ND	8.7	1248+1254
B-3,3	H-4	14-20"	ND	1.0U	--
B-3,4	J-4	0-6"	ND	14	1254
B-3,4	J-4	9-15"	ND	2.1	1248
B-4,2	F-2	0-6"	ND	1.0U	--
B-4,2	F-2	6-12"	ND	1.0U	--
B-4,3	H-2	0-6"	ND	1.0U	--
B-4,3	H-2	6-12"	ND	1.0U	--
B-4,4	J-2	0-6"	ND	1.0U	--
B-4,4	J-2	6-12"	ND	1.2	1254

(a)Samples were collected from April 5, 1985 to April 8, 1985.

(b)The upper depth at each sampling station represents sludge materials, while the lower depth represents the underlying soil. The grid coordinate system indicates the closest corresponding sampling locations between the old and new grid systems, although the coordinate systems do not exactly correspond.

(c)"mg/kg" = milligrams per kilogram or parts per million on a dry weight basis.

(d)The indicated commercial aroclor mixture represents the source of the polychlorinated biphenyl contamination and the standard used for instrument calibration and analysis. All samples were screened for Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260 to determine which aroclors are present in the sample and therefore should be used for instrument calibration.

(e)"ND" indicates not determined.

(f)"U" indicates that the compound was analyzed, but not detected. The corresponding number represents the method detection limit for the sample.

(g)"--" indicates that PCBs were not detected in the corresponding sample. Therefore, no source aroclor is given.

TABLE C.10

SUMMARY OF POLYCHLORINATED BIPHENYLS (PCB) RESULTS
NOVEMBER 1986 SWAMP AREA SLUDGES AND SOILS(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN, OHIO

SAMPLE IDENTIFICATION AREA NO. 1	DEPTH INTERVAL (ft)	POLYCHLORINATED BIPHENYLS mg/kg(b)	SOURCE AROCLOR(c)
B-4	0.0-1.0	0.16U(d)	--(e)
B-6	0.0-1.0	0.16U	--
B-7	0.0-1.0	0.17	1254
C-6	0.0-1.2	1.7	1248 & 1254
C-6	1.2-2.2	0.16U	--
C-7	0.0-1.0	0.16U	--
D-2	0.0-1.0	0.22U	1254
D-4	0.0-1.2	0.75	1248 & 1254
D-4	1.2-2.2	0.16U	--
D-5	0.0-0.3	0.16U	--
D-5	0.3-1.3	0.16U	--
D-6	0.0-0.3	0.16U	--
D-6	0.3-1.3	0.16U	--
D-7	0.0-0.8	0.16U	--
D-7	0.8-1.8	0.16U	--
E-3	0.0-1.0	0.16U	--
E-4	0.0-1.5	0.69	1248 & 1254
E-4	1.5-2.5	0.16U	--
E-5	0.0-0.5	0.16	1254
E-5	0.5-1.5	0.16U	--
E-6	0.0-0.6	0.16U	--
E-6	0.6-1.6	0.16U	--
E-7	0.0-2.3	0.89	1248 & 1254
E-7	2.3-3.3	0.16U	--
E-8	0.0-5.5	0.17	1254
E-8	5.5-6.5	0.16U	--
E-9	0.0-3.5	0.87	1248 & 1254
E-9	3.5-4.5	0.16U	--

TABLE C.10
(Continued)

SAMPLE IDENTIFICATION AREA NO. 2	DEPTH INTERVAL (ft)	POLYCHLORINATED BIPHENYLS mg/kg(b)	Source Aroclor(c)
F-4	0.0-0.5	0.16U	--
F-4	0.5-1.5	0.16U	--
F-5	0.0-1.0	0.68	1248 & 1254
F-5	1.0-2.0	0.16U	--
F-6	0.0-1.2	2.2	1248 & 1254
F-6	1.2-2.2	0.16U	--
F-7	0.0-2.0	2.5	1248 & 1254
F-7	2.0-3.0	0.16U	--
F-8	0.0-3.3	0.56	1248 & 1254
F-8	3.3-4.3	0.16U	--
F-9	0.0-0.5	0.16U	--
F-9	0.5-1.5	0.16U	--
G-4	0.0-0.8	0.16U	--
G-4	0.8-1.8	0.21	1248
G-5	0.0-1.5	4.5	1248 & 1254
G-5	1.5-2.5	3.7	1248
G-6	0.0-0.6	0.37	1254
G-6	0.6-1.6	0.16U	--
G-7	0.0-1.5	5.5	1248
G-7	1.5-2.5	0.11	1248
G-8	0.0-3.0	4.3	1248
G-8	3.0-4.0	0.16U	1248
G-9	0.0-3.0	0.28	1254
G-9	3.0-4.0	0.16U	--
G-10	0.0-3.5	0.56	1248 & 1254
G-10	3.5-4.5	0.16U	--

TABLE C.10
(Continued)

SAMPLE IDENTIFICATION AREA NO. 3	DEPTH INTERVAL (ft)	POLYCHLORINATED BIPHENYLS mg/kg(b)	SOURCE AROCLOR(c)
F-1	0.0.1.0	0.27	1248 & 1254
F-2	0.0-1.0	0.16U	--
F-3	0.0-0.5	0.16U	--
F-3	0.5-1.5	0.16U	--
G-1	0.0-1.0	0.36	1248 & 1254
G-2	0.0-0.6	0.16U	--
G-2	0.6-1.6	0.18	1248
G-3	0.0-1.8	0.59	1248 & 1254
G-3	1.8-2.8	0.16U	--
H-1	0.0-1.0	0.42	1248 & 1254
H-2	0.0-1.0	0.16U	--
H-3	0.0-1.0	0.16U	--
H-3	1.0-2.0	0.16U	--
I-1	0.0-1.0	0.39	1248 & 1254
I-2	0.0-1.0	0.24	1254
I-3	0.0-0.5	1.8	1248 & 1254
I-3	0.5-1.5	0.52	1248 & 1254
J-1	0.0-1.0	0.36	1254
J-2	0.0-0.8	0.32	1248 & 1254
J-2	0.8-1.8	0.16U	--
J-3	0.0-0.2	1.9	1248 & 1254
J-3	0.2-1.2	0.80	1248 & 1254

TABLE C.10
(Continued)

SAMPLE IDENTIFICATION AREA NO. 4	DEPTH INTERVAL (ft)	POLYCHLORINATED BIPHENYLS mg/kg(b)	SOURCE AROCLOR(c)
H-4	0.0-1.8	2.8	1248 & 1254
H-4	1.8-3.0	0.09	1248
H-5	0.0-1.7	5.1	1248 & 1254
H-5	1.7-3.2	0.15	1248
H-6	0.0-1.3	6.5	1248 & 1254
H-6	1.3-2.3	0.51	1248
H-7	0.0-1.3	21	1248 & 1254
H-7	1.3-2.3	0.91	1248
H-8	0.0-2.0	21	1248 & 1254
H-8	2.0-3.0	0.65	1248
H-9	0.0-2.8	2.7	1248 & 1254
H-9	2.8-3.8	0.58	1248
H-10	0.0-3.5	3,000	1248
H-10	3.5-4.5	1.1	1248
I-4	0.0-1.5	12	1248 & 1254
I-4	1.5-2.5	0.19	1248
I-5	0.0-1.5	51	1248 & 1254
I-5	1.5-2.5	5.9	1248 & 1254
I-6	0.0-1.0	68	1248 & 1254
I-6	1.0-2.0	11	1248
I-7	0.0-1.5	108	1248 & 1254
I-7	1.5-2.5	7.5	1248
I-8	0.0-2.5	51	1248
I-8	2.5-3.5	0.44	1248
I-9	0.0-2.5	160	1248
I-9	2.5-3.5	1.6	1248
I-10	0.0-3.5	93	1248 & 1254
I-10	3.5-4.5	0.41	1248
J-4	0.0-1.8	22	1248 & 1254
J-4	1.8-2.8	6.4	1248
J-5	0.0-1.5	95	1248 & 1254
J-5	1.5-2.5	9.8	1248
J-6	0.0-1.5	89	1248 & 1254
J-6	1.5-2.5	11	1248
J-7	0.0-1.5	65	1248 & 1254
J-7	1.5-2.5	3.8	1248
J-8	0.0-1.5	54	1248 & 1254
J-8	1.5-2.5	4.8	1248
J-9	0.0-3.0	220	1248 & 1254
J-9	3.0-4.0	23	1248
J-10	0.0-4.0	61	1248
J-10	4.0-5.0	0.16U	--

TABLE C.10
(Continued)

SAMPLE IDENTIFICATION AREA NO. 5	DEPTH INTERVAL (ft)	POLYCHLORINATED BIPHENYLS mg/kg(b)	SOURCE AROCLOR(c)
K-2	0.0-1.0	1.9	1248 & 1254
K-3	0.0-0.8	14	1248 & 1254
K-3	0.8-1.8	0.12	1248
K-4	0.0-1.5	21	1248 & 1254
K-4	1.5-2.5	4.9	1248
K-5	0.0-2.3	42	1248 & 1254
K-5	2.3-3.3	19	1248
K-6	0.0-1.0	110	1248 & 1254
K-6	1.0-2.0	23	1248 & 1254
K-7	0.0-1.0	11	1248 & 1254
K-7	1.0-2.0	0.42	1248
K-8	0.0-0.7	3.5	1248 & 1254
K-8	0.7-1.7	1.6	1248
KL-6	0.0-0.4	9.3	1248 & 1254
KL-6	0.4-1.4	0.75	1248 & 1254
KL-7	0.0-2.0	1.0	1248 & 1254
KL-7	2.0-3.0	4.2	1248 & 1254
KL-8	0.0-0.2	66	1248 & 1254
KL-8	0.2-1.2	1.2	1248
L-2	0.0-1.0	0.25	1254
L-3	0.0-1.0	1.2	1248 & 1254
L-4	0.0-1.0	7.4	1248 & 1254

(a)Samples were collected on November 24, 25, and 26, 1986 and December 2, 1986.

(b)"mg/kg" equals milligrams per kilogram or parts per million (ppm).

(c)The indicated commercial aroclor mixture represents the source of the polychlorinated biphenyl contamination and the standard used for instrument calibration and analysis. All samples were screened for Aroclors 1016, 1221, 1232, 1242, 1254, and 1260 to determine which aroclors are present in the sample and therefore should be used for instrument calibration.

(d)"U" indicates that the compound was analyzed, but not detected. The corresponding number represents the method detection limit for the sample.

(e)"--" indicates that PCBs were not detected in the corresponding sample.

TABLE C.11

SUMMARY OF POLYCHLORINATED BIPHENYLS (PCB) RESULTS
MARCH 1987 SWAMP AREA SLUDGES AND SOILS(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN, OHIO

SAMPLE IDENTIFICATION AREA NO. 2	DEPTH INTERVAL (ft)	POLYCHLORINATED BIPHENYLS mg/kg(b)	SOURCE AROCLOR(c)
G-10.5	0.0-0.5	0.30U(d)	--(e)
G-10.5	0.5-1.5	0.11U	--
AREA NO. 4			
GH-9.5	0.0-3.0	0.91	1248
GH-9.5	3.0-4.0	0.11	1248
GH-10	0.0-3.0	4.3	1242
GH-10	3.0-4.0	0.16	1242
GH-10.5	0.0-3.5	9.0	1248
GH-10.5	3.5-4.5	0.12U	--
H-9.5	0.0-3.0	39	1248
H-9.5	3.0-4.0	0.23	1248
H-10.5	0.0-2.0	480	1248
H-10.5	2.0-3.0	8.0	1248
HI-8.5	0.0-2.0	98	1242
HI-8.5	2.0-3.0	2.4	1242
HI-9.5	0.0-2.5	77	1242
HI-9.5	2.5-3.5	2.3	1242
HI-10	0.0-3.0	400	1248
HI-10	3.0-4.0	2.8	1248
HI-10.5	0.0-2.0	160	1242
HI-10.5	2.0-3.0	6.4	1242
I-10.5	0.0-3.0	58	1248
I-10.5	3.0-4.0	2.3	1248
IJ-8	0.0-1.5	60	1248
IJ-8	1.5-2.5	0.43	1248
IJ-9	0.0-2.5	78	1242
IJ-9	2.5-3.5	2.7	1242
IJ-10	0.0-3.5	57	1248
IJ-10	3.5-4.5	0.52	1248
JK-8	0.0-1.0	35	1248
JK-8	1.0-2.0	2.6	1248
JK-9	0.0-3.0	140	1248
JK-9	3.0-4.0	0.60	1248
JK-10	0.0-4.0	4.5	1248
JK-10	4.0-5.0	0.92	1248

TABLE C.11
(Continued)

SAMPLE IDENTIFICATION AREA NO. 5	DEPTH INTERVAL (ft)	POLYCHLORINATED BIPHENYLS mg/kg(b)	SOURCE AROCLOR(c)
KL-5	0.0-1.0	0.20U	--
KL-8.5	0.0-1.0	0.18U	--
M-2.5	0.0-1.0	0.22U	--
M-3	0.0-1.0	0.44U	--
M-4	0.0-1.0	1.0	1254
N-2	0.0-1.0	0.21	1248
N-3	0.0-1.0	0.23U	--
N-4	0.0-1.0	0.18U	--

(a)Samples were collected on March 26, 1987.
(b)"mg/kg" equals milligrams per kilogram or parts per million (ppm).

(c)The indicated commercial aroclor mixture represents the source of the polychlorinated biphenyl contamination and the standard used for instrument calibration and analysis. All samples were screened for Aroclors 1016, 1221, 1232, 1242, 1254, and 1260 to determine which aroclors were present in the sample and therefore should be used for instrument calibration.

(d)"U" indicates that the compound was analyzed, but not detected. The corresponding number represents the method detection limit for the sample.

(e)"--" indicates that PCBs were not detected in the corresponding sample.

TABLE C.12

SUMMARY OF GENERAL INORGANIC AND E.P. TOXICITY TEST METHOD RESULTS
MARCH 1985 MONITORING WELL SOIL BORING SAMPLES(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN OHIO

PARAMETERS	CONCENTRATION UNITS	SAMPLE IDENTIFICATION													
		MW-1, S-5		MW-1, S-9		MW-2, S-1		MW-2 S-4		MW-2, S-6		MW-3, S-1		MW-3 S-3	
		TOTAL(b)	E.P. TOX.(c)	TOTAL	E.P. TOX.	TOTAL	E.P. TOX.	TOTAL	E.P. TOX.	TOTAL	E.P. TOX.	TOTAL	E.P. TOX.	TOTAL	E.P. TOX
Cyanide, Amenable	ppm(d)	<0.5(e)	<0.02	<0.5	<0.02	18	<0.02	1.2	<0.02	<0.5	<0.02	<0.5	<0.02	5.0	<0.02
Cyanide, Total	ppm	<0.5	<0.02	<0.5	<0.02	60	<0.02	2.8	<0.02	<0.5	<0.02	2.2	<0.02	5.0	<0.02
Fluoride	ppm	2.2	0.1	1.2	0.1	6.4	1.1	31	0.3	1.3	0.2	40	0.4	[illegible]	0.6
Metals:															
Chromium, Hexavalent	ppm	<0.1	<0.01	<0.1	0.02	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01
Chromium, Total	ppm	16	0.02	12	0.05	950	0.78	47	0.03	17	0.07	91	0.07	57	0.04
Iron	ppm	28,000	37	15,000	2.5	57,000	2.1	29,000	59	18,000	58	28,000	22	29,000	<0.01
Manganese	ppm	680	22	350	5.1	1,000	24	540	8.7	560	12	940	13	580	3.7

TABLE C.12
(Continued)

PARAMETERS	CONCENTRATION UNITS	SAMPLE IDENTIFICATION MW-3, S-7 TOTAL(b)	MW-3, S-7 E.P. TOX.(c)	MW-4, S-1 TOTAL	MW-4, S-1 E.P. TOX.	MW-4, S-4 TOTAL	MW-4, S-4 E.P. TOX.	MW-4, S-10 TOTAL	MW-4, S-10 E.P. TOX.
Cyanide, Amenable	ppm	<0.5	<0.02	<0.5	<0.02	<0.5	<0.02	0.7	<0.02
Cyanide, Total	ppm	<0.5	<0.02	25	0.02	<0.5	<0.02	0.7	<0.02
Fluoride	ppm	2.7	0.2	2.6	2.3	24	0.3	1.2	0.1
Metals:									
Chromium, Hexavalent	ppm	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01
Chromium, Total	ppm	13	0.05	280	0.29	28	0.04	12	0.05
Iron	ppm	17,000	5.4	41,000	0.22	84,000	160	16,000	36
Manganese	ppm	470	12	960	17	600	4.4	370	6.2

PARAMETERS	CONCENTRATION UNITS	MW-5 S-1 TOTAL	MW-5 S-1 E.P. TOX.	MW-5, S-3 TOTAL	MW-5, S-3 E.P. TOX.	MW-5, S-7 TOTAL	MW-5, S-7 E.P. TOX
Cyanide, Amenable	ppm	<0.5	<0.02	<0.5	<0.02	<0.5	<0.02
Cyanide, Total	ppm	2.9	0.02	1.8	<0.02	1.7	<0.02
Fluoride	ppm	86	1.4	21	0.3	18	0.3
Metals:							
Chromium, Hexavalent	ppm	<0.1	0.12	<0.1	<0.01	<0.1	<0.01
Chromium, Total	ppm	87	0.14	27	0.02	10	0.04
Iron	ppm	29,000	<0.01	52 000	37	32,000	12
Manganese	ppm	1,300	1.7	710	7.6	390	8.4

TABLE C.12
(Continued)

PARAMETERS	CONCENTRATION UNITS	SAMPLE IDENTIFICATION MW-6, S-4		MW-6 S-7		MW-6 S-8		MW-7, S-1		MW-7, S-3		MW-7 S-5		MW-8, S-3	
		TOTAL(b)	E.P. TOX.(c)	TOTAL	E.P. TOX.	TOTAL	E.P. TOX.	TOTAL	E.P. TOX.	TOTAL	E.P. TOX.	TOTAL	E.P. TOX.	TOTAL	E.P. TOX
Cyanide, Amenable	ppm	<0.5	<0.02	<0.5	<0.02	<0.5	<0.02	0.7	<0.02	<0.5	<0.02	<0.5	<0.02	<0.5	<0.02
Cyanide, Total	ppm	<0.5	<0.02	<0.5	<0.02	<0.5	<0.02	0.7	<0.02	<0.5	<0.02	0.7	<0.02	<0.5	<0.02
Fluoride	ppm	1.5	0.3	1.1	0.1	1.0	0.1	25	0.2	14	0.2	6.9	0.2	1.4	<0.1
Metals:															
Chromium, Hexavalent	ppm	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01	<0.1	0.03	<0.1	<0.01	<0.1	<0.01
Chromium, Total	ppm	21	0.06	12	0.06	7.4	0.04	40	0.02	18	0.04	10	0.06	13	0.04
Iron	ppm	38,000	57	13,000	31	12,000	16	37,000	0.05	42,000	30	14,000	4.1	28,000	37
Manganese	ppm	680	10	380	7.5	290	6.6	1 300	15	880	21	420	8.6	650	12

TABLE C.12
(Continued)

PARAMETERS	CONCENTRATION UNITS	SAMPLE IDENTIFICATION MW-8, S-4 TOTAL(b)	MW-8, S-4 E.P. TOX.(c)	MW-8, S-6 TOTAL	MW-8, S-6 E.P. TOX.	MW-9, S-2 TOTAL	MW-9, S-2 E.P. TOX.	MW-9, S-3 TOTAL	MW-9, S-3 E.P. TOX.	MW-9, S-6 TOTAL	MW-9, S-6 E.P. TOX.	MW-9, S-8 TOTAL	MW-9, S-8 E.P. TOX.
Cyanide, Amenable	ppm	<0.5	<0.02	<0.5	<0.02	3.4	<0.02	0.9	<0.02	<0.5	<0.02	<0.5	<0.02
Cyanide, Total	ppm	<0.5	<0.02	<0.5	<0.02	4.0	<0.02	1.8	<0.02	<0.5	<0.02	<0.5	<0.02
Fluoride	ppm	1.0	<0.1	0.6	0.1	8.1	0.1	7.0	0.2	7.6	0.3	6.8	0.3
Metals:													
Chromium, Hexavalent	ppm	0.5	<0.01	<0.1	0.02	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01
Chromium, Total	ppm	21	0.04	11	0.08	21	0.05	19	0.05	10	0.06	13	0.08
Iron	ppm	35,000	91	17,000	35	47,000	<0.01	40,000	9.7	13,000	12	15,000	32
Manganese	ppm	760	12	340	7.5	890	2.3	980	30	320	6.3	320	7.2

(a)Monitoring well soil boring samples were collected from March 18, 1985 to April 9, 1985.

(b)The indicated values represent the total concentration in milligrams per kilogram (mg/kg) or parts per million (ppm) of the corresponding parameter present in the sample.

(c)"E.P. TOX" refers to EP toxicity leachate generated by the Extraction Procedure (EP) Toxicity Test Method, SW-1310, as described in "U.S. Environmental Protection Agency, 1984," Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," SW-846, Second Edition Revised, Waste Characterization Branch, Office of Solid Waste, Washington, DC.

(d)The units for total constituent analyses are reported in milligrams per kilogram (mg/kg) or parts per million (ppm). The EP Toxicity Test Method leachate analyses are reported in milligrams per liter (mg/l) or ppm.

(e)"<" = less than the reported value which is the detection limit of the analysis.

00022256

TABLE C.13

CYANIDE SUMMARY OF QUARTERLY GROUND WATER MONITORING(a) ARCO CHEMICAL COMPANY GNADENHUTTEN, OHIO

QUARTERLY MONITORING	CONCENTRATION UNITS	SAMPLE IDENTIFICATION MW-2 UPPER ZONE	MW-2 LOWER ZONE	MW-3 UPPER ZONE	MW-3 LOWER ZONE	MW-4 UPPER ZONE	MW-4 LOWER ZONE	MW-5 UPPER ZONE	MW-5 LOWER ZONE	MW-9 UPPER ZONE	MW-9 LOWER ZONE
April 9-12, 1985											
Cyanide, Total	mg/l(b)	0.22	0.23	0.36	0.29	0.35	0.26	0.04	0.05	0.08	0.07
July 30-31, 1985											
Cyanide, Total	mg/l	0.07	0.11	0.02U(c)	0.06	0.17	0.21	0.07	0.05	0.10	0.08
November 4-5, 1985											
Cyanide, Total	mg/l	0.03	0.03	0.23	0.47	0.09	0.08	0.08	0.05	0.05	0.03
January 29-30, 1986											
Cyanide, Total	mg/l	0.21	0.27	0.25	0.33	0.17	0.13	0.09	0.12	0.15	0.18
November 18-20, 1986											
Cyanide, Total	mg/l	0.17	0.13	0.28	0.21	0.25	0.14	0.11	0.12	0.06	0.05
January 27-29, 1987											
Cyanide, Total	mg/l	0.18	0.23	0.39	0.39	0.05	0.12	0.70	0.50	0.02	0.02

(a)Cyanide concentrations are summarized for those monitoring wells which exhibited values greater than 0.02 milligram per liter (mg/l).

(b)"mg/l" = milligrams per liter or parts per million (ppm).

(c)"U" indicates that the compound was analyzed, but not detected. The corresponding number represents the method detection limit for the sample.

TABLE C.14

CHROMIUM SUMMARY OF
QUARTERLY GROUND WATER MONITORING(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN OHIO

QUARTERLY MONITORING	CONCENTRATION UNITS	SAMPLE IDENTIFICATION MW-2 UPPER ZONE	MW-2 LOWER ZONE	MW-3 UPPER ZONE	MW-3 LOWER ZONE	MW-5 UPPER ZONE	MW-5 LOWER ZONE	MW-7 UPPER ZONE	MW-7 LOWER ZONE	MW-8 UPPER ZONE	MW-8 LOWER ZONE	MW-9 UPPER ZONE	MW-9 LOWER ZONE	PW-4
April 9-12, 1985														
Chromium, Hexavalent	mg/l(b)	0.01U(c)	0.01U	0.01U	0.01U	0.01U	0.01U	0.01	0.01U	0.01U	0.01U	0.14	0.14	0.01U
Chromium, Total	mg/l	0.02	0.01U	0.04	0.01U	0.02	0.03	0.11	0.01U	0.03	0.02	0.14	0.14	0.08
July 30-31, 1985														
Chromium, Hexavalent	mg/l	0.01U	0.01U	0.13	0.13	0.01U	0.01U	0.10	0.10	0.01U	0.01U	0.14	0.10	0.01U
Chromium, Total	mg/l	0.01U	0.01U	0.11	0.13	0.01U	0.01U	0.05	0.05	0.01U	0.01U	0.10	0.06	0.01U
November 4-5, 1985														
Chromium, Hexavalent	mg/l	0.01U	0.01U	0.02	0.01	0.01U	0.01U	0.08	0.07	0.01U	0.01U	0.10	0.10	0.01U
Chromium, Total	mg/l	0.05	0.01U	0.04	0.03	0.01U	0.01U	0.06	0.06	0.01U	0.01U	0.10	0.08	0.01U
January 29-30, 1986														
Chromium, Hexavalent	mg/l	0.01U	0.03	0.04	0.03	0.01U	0.01	0.08	0.05	0.01U	0.01U	0.13	0.13	0.02
Chromium, Total	mg/l	0.02	0.02	0.02	0.02	0.01U	0.01U	0.04	0.04	0.01U	0.01U	0.11	0.11	0.02
November 18-20, 1986														
Chromium, Hexavalent	mg/l	0.03	0.03	0.01	0.05	0.01U	0.01U	0.03	0.01	0.03	0.01U	0.06	0.06	0.01U
Chromium, Total	mg/l	0.02	0.02	0.01	0.01U	0.01U	0.01U	0.02	0.01	0.01U	0.01U	0.04	0.04	0.01U
January 27-29, 1987														
Chromium, Hexavalent	mg/l	0.02	0.01U	0.02	0.03	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.02	0.01U	0.01U

(a)Chromium concentrations are summarized for those monitoring wells which exhibited values greater than 0.02 milligram per liter (mg/l).

(b)"mg/l" = milligrams per liter or parts per million (ppm).

(c)"U" indicates that the compound was analyzed, but not detected. The corresponding number represents the method detection limit for the sample.

00002258

TABLE C.15

FLUORIDE SUMMARY OF
QUARTERLY GROUND WATER MONITORING(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN, OHIO

QUARTERLY MONITORING	CONCENTRATION UNITS	SAMPLE IDENTIFICATION MW-2 UPPER ZONE	MW-2 LOWER ZONE	MW-3 UPPER ZONE	MW-3 LOWER ZONE	MW-4 UPPER ZONE	MW-4 LOWER ZONE	MW-5 UPPER ZONE	MW-5 LOWER ZONE	MW-7 UPPER ZONE	MW-7 LOWER ZONE	MW-9 UPPER ZONE	MW-9 LOWER ZONE
April 9-12, 1985	mg/l(b)	0.6	0.6	5.9	5.7	8.0	7.8	4.2	4.4	2.0	1.6	7.2	6.8
July 30-31, 1985	mg/l	0.2	0.2	1.8	1.8	8.7	8.6	3.8	3.7	2.0	2.2	5.6	4.8
November 4-5, 1985	mg/l	0.1	0.1	4.0	4.4	8.3	8.2	3.6	3.7	2.3	2.3	7.2	7.2
January 29-30, 1986	mg/l	0.5	0.5	6.0	5.9	7.3	7.4	3.4	3.6	2.6	2.6	7.1	7.0
November 18-20, 1986	mg/l	0.3	0.3	6.4	5.6	6.0	6.4	3.5	3.8	2.4	2.4	4.0	3.9

(a)Fluoride concentrations are summarized for those monitoring wells which exhibited values greater than 1.0 milligram per liter (mg/l).

(b)"mg/l" = milligrams per liter or parts per million (ppm).

TABLE C.16

NITRATE SUMMARY OF
QUARTERLY GROUND WATER MONITORING(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN, OHIO

QUARTERLY MONITORING	CONCENTRATION UNITS	SAMPLE IDENTIFICATION															
		MW-1		MW-2		MW-3		MW-4		MW-6		MW-7		MW-8		MW-9	
		UPPER ZONE	LOWER ZONE	UPPER ZONE	LOWER ZONE	UPPER ZONE	LOWER ZONE	UPPER ZONE	LOWER ZONE	UPPER ZONE	LOWER ZONE	UPPER ZONE	LOWER ZONE	UPPER ZONE	LOWER ZONE	UPPER ZONE	LOWER ZONE
April 9-12, 1985	mg/l NO_3-N(b)	1.6	1.0	1.7	1.3	9.1	11	<0.1	<0.1	19	21	0.8	0.3	<0.1(c)	<0.1	2.1	2.4
July 30-31, 1985	mg/l NO_3-N	2.9	4.4	3.3	3.6	8.2	6.1	0.7	0.2	5.0	5.6	6.4	7.4	0.8	<0.1	2.0	1.5
November 4-5, 1985	mg/l NO_3-N	2.4	1.3	5.0	4.8	3.0	2.7	<0.1	<0.1	6.4	6.6	7.2	7.3	1.6	1.0	1.0	1.0
January 29-30, 1986	mg/l NO_3-N	3.4	2.9	4.2	3.0	5.9	5.4	0.2	0.2	8.2	8.1	3.4	3.2	0.9	0.7	1.0	1.0
November 18-20, 1986	mg/l NO_3-N	3.6	3.8	2.8	2.7	4.0	4.3	1.7	1.4	6.4	6.6	1.0	0.6	0.9	0.3	0.7	1.2

(a)Nitrate concentrations are summarized for those monitoring wells which exhibited values greater than 1.0 milligram per liter (mg/l).
(b)"mg/l" = milligrams per liter or parts per million (ppm).
(c)"<" = less than the reported value which is the detection limit of the analysis.

TABLE C.17

SELENIUM SUMMARY OF
QUARTERLY GROUND WATER MONITORING(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN, OHIO

QUARTERLY MONITORING	CONCENTRATION UNITS	SAMPLE IDENTIFICATION MW-1 UPPER ZONE	MW-1 LOWER ZONE	MW-2 UPPER ZONE	MW-2 LOWER ZONE	MW-3 UPPER ZONE	MW-3 LOWER ZONE	MW-5 UPPER ZONE	MW-5 LOWER ZONE	MW-6 UPPER ZONE	MW-6 LOWER ZONE	MW-7 UPPER ZONE	MW-7 LOWER ZONE	MW-8 UPPER ZONE	MW-8 LOWER ZONE	PW-4	PW-5
April 9-12, 1985	mg/l(b)	0.007	0.008	0.014	0.015	0.010	0.007	0.001	<0.001	0.004	0.004	0.002	0.002	0.002	0.001	0.002	0.001
July 30-31, 1985	mg/l	<0.01(c)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
November 4-5, 1985	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
January 29-30, 1986	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
November 18-20, 1986	mg/l	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.012	0.013	<0.005	<0.005	0.006	0.007	0.008	0.005	0.008	0.007

(a)Selenium concentrations are summarized for those monitoring wells which exhibited values greater than 0.002 milligram per liter (mg/l).

(b)"mg/l" = milligrams per liter or parts per million (ppm).

(c)"<" = less than the reported value which is the detection limit of the analysis.

00022261

TABLE C 18

SUMMARY OF HAZARDOUS SUBSTANCE LIST ORGANIC COMPOUND RESULTS
APRIL 1985 FIRST QUARTER GROUND WATER MONITORING(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN, OHIO

PARAMETERS	CAS NUMBER(b)	CONCENTRATION UNITS	SAMPLE IDENTIFICATION MW-1 20 FEET	MW-2 18 FEET	MW-3 16 FEET	MW-5 17 FEET	MW-6 19 FEET	PW-5 PUMP ZONE
Volatiles:								
Tetrachloroethylene	127-18-4	ug/l(c)	6.8	5.3	9.7	BDL	BDL	BDL
Other Volatiles	--	ug/l	BDL(d)	BDL	BDL	BDL	BDL	BDL
Acid/Base-Neutral Extractables	--	ug/l	BDL	BDL	BDL	BDL	BDL	BDL
Pesticides/Polychlorinated Biphenyls	--	ug/l	BDL	BDL	BDL	BDL	BDL	BDL

(a)First quarter ground water monitoring samples were collected from April 9, 1985 to April 12, 1985.

(b)The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

(c)"ug/l" = micrograms per liter or parts per billion (ppb).

(d)"BDL" indicates not detected above the U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Hazardous Substance List (HSL) contract required detection limits (CRDL).

TABLE C.19

SUMMARY OF HAZARDOUS SUBSTANCE LIST ORGANIC COMPOUND RESULTS
JULY 1985 SECOND QUARTER GROUND WATER MONITORING(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN, OHIO

		SAMPLE IDENTIFICATION									
PARAMETERS	CONCENTRATION UNITS	MW-1 29 FEET	MW-2 23 FEET	MW-3 24 FEET	MW-4 17 FEET	MW-5 18 FEET	MW-6 25 FEET	MW-8 17 FEET	MW-9 22 FEET	PW-4 PUMP ZONE	PW-5 PUMP ZONE
Volatiles	ug/l(b)	BDL(c)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Acid/Base-Neutral Extractables	ug/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

(a)Second quarter ground water monitoring samples were collected from July 30, 1985 to July 31, 1985.

(b)"ug/l" = micrograms per liter or parts per billion (ppb).

(c)"BDL" indicates not detected above the U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Hazardous Substance List (HSL) contract required detection limits (CRDL).

00022263

TABLE C.20

SUMMARY OF HAZARDOUS SUBSTANCE LIST ORGANIC COMPOUND RESULTS
NOVEMBER 1986 FINAL QUARTER GROUND WATER MONITORING(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN, OHIO

PARAMETERS	CAS REGISTRY NUMBER(b)	CONCENTRATION UNITS	MW-1 27 FEET	MW-2 23 FEET	MW-3 24 FEET	MW-4 20 FEET	MW-5 19 FEET	MW-6 26 FEET	MW-7 17 FEET	MW-8 23 FEET	MW-9 16 FEET	PW-4 PUMP ZONE	PW-5 PUMP ZONE
Volatiles:													
Methylene Chloride	75-09-2	ug/l(c)	13B(d)	17B	14B	11B	11B	12B	5.1B	8.3B	7.0B	15B	8.9B
Acetone	67-64-1	ug/l	13B	15B	46B	36B	31B	BDL(e)	52B	97B	26B	140B	BDL
Toluene	108-88-3	ug/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	6.9	BDL
Total Xylene(f)	1330-20-7	ug/l	6.2B	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	13B	BDL
Acid/Base-Neutral Extractables:													
1,3-Dichlorobenzene	541-73-1	ug/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	13B	BDL	BDL	BDL

(a)Final quarter ground water monitoring samples were collected from November 18, 1986 to November 20, 1986.

(b)The numbers presented in this column are the Chemical Abstracts Service (CAS) Registry Numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

(c)"ug/l" = micrograms per liter or parts per billion (ppb).

(d)"B" indicates that the corresponding compound was found in the blank as well as the sample.

(e)"BDL" indicates not detected above the U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Hazardous Substance List (HSL) contract required detection limits (CRDL).

TABLE C.21

SUMMARY OF CHROMIUM AND POLYCHLORINATED BIPHENYLS RESULTS FOR THE NOVEMBER 1986 RIVER SEDIMENT SAMPLES(a)
ARCO CHEMICAL COMPANY
GNADENHUTTEN, OHIO

SAMPLE IDENTIFICATION	TOTAL CHROMIUM (mg/kg)(b)	HEXAVALENT CHROMIUM (mg/kg)	POLYCHLORINATED BIPHENYLS (mg/kg)
RS-2-1	38	0.15J(c)	0.16U(d)
RS-2-2	70	1.2U	0.16U
RS-2-3	78	0.29J	0.16U
RS-2-4	67	0.14J	0.16U
RS-2-5	83	1.2U	0.16U
RS-2-6	61	1.2U	0.16U
RS-2-7	82	0.43J	0.16U
RS-2-8	74	0.44J	0.16U
RS-2-9	57	0.33J	0.16U
RS-4-2	78	0.84J	0.16U
RS-5-2	120	0.74J	0.16U
RS-6-2	82	1.1U	0.16U
RS-7-1	120	1.5	0.16U
RS-7-2	60	0.91J	0.16U
RS-7-3	69	0.89J	0.16U
RS-7-4	89	0.29J	0.16U
RS-7-5	81	0.27J	0.16U
RS-7-6	58	0.29J	0.16U
RS-7-7	56	0.56J	0.16U
RS-8-2	120	1.5	0.16U
RS-9-2	100	0.42J	0.47(e)
RS-10-1	180	0.17J	0.16U
RS-10-2	83	0.58J	0.16U
RS-10-3	85	0.45J	0.16U
RS-10-4	29	0.27J	0.16U
RS-10-5	32	0.41J	0.16U
RS-11-2	46	0.13J	0.16U
RS-12-2	55	1.3U	0.11(f)
RS-14-1	120	1.3U	0.16U
RS-14-2	65	1.2U	0.16U
RS-14-3	71	1.2U	0.16U
RS-14-4	67	0.14J	0.16U
RS-14-5	45	1.1U	0.16U
RS-14-6	51	1.1U	0.16U
RS-14-7	49	3.2U	0.16U
RS-14-8	100	1.4U	0.16U
Composite RS-1,2,3 Traverses	17	1.2U	0.16U
Composite RS-4,5,6 Traverses	38	4.1	0.16U
Composite RS-7,8,9 Traverses	48	1.1U	0.16U
Composite RS-10,11,12 Traverses	33	3.1U	0.16U
Composite RS-13,14,15 Traverses	59	3.0U	0.16U

(a)Samples were collected from November 11, 1986 to November 14, 1986.

(b)"mg/kg" equals milligrams per kilogram or parts per million (ppm)

(c)"J" indicates that the corresponding compound is present, but the calculated concentration is less than the specified detection limit.

(d)"U" indicates that the compound was analyzed, but not detected. The corresponding number represents the method detection limit for the sample.

(e)The source aroclors for the indicated polychlorinated biphenyls were Aroclor 1248 and 1254.

(f)The source aroclor for the indicated polychlorinated biphenyls was Aroclor 1248.